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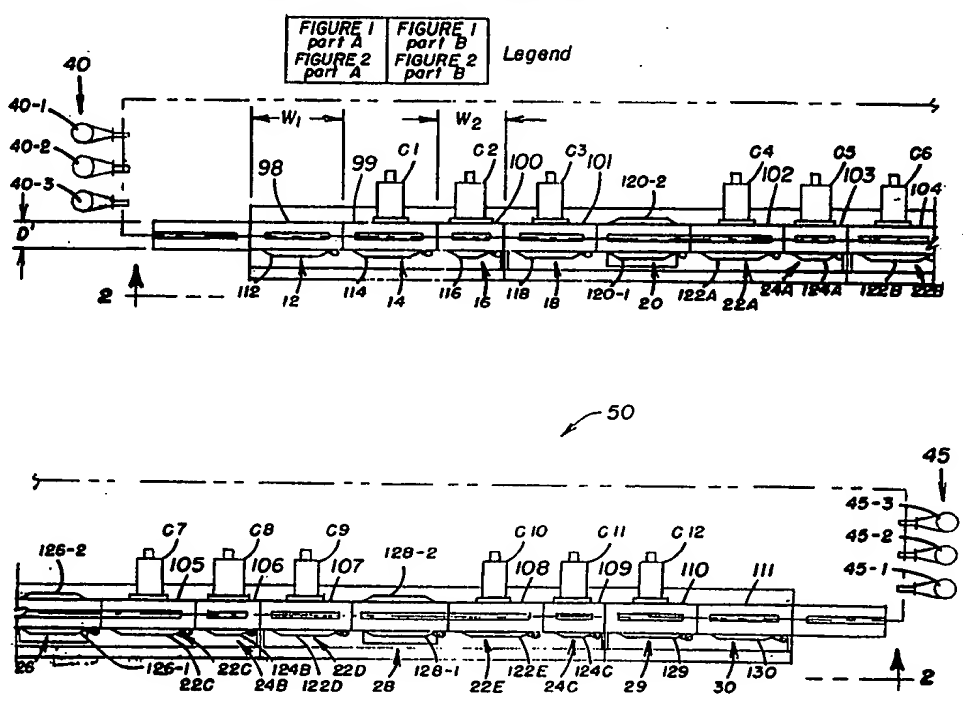

(57) Abstract

An apparatus provides a single or multi-layer coating to the surface of a plurality of substrates. The apparatus includes a plurality of buffer and sputtering chambers (12, 18, 20, 22A-E, 24A-C, 26 and 28-30), and an input end and an output end. The substrates are transported through said chambers (12, 18, 20, 22A-E, 24A-C, 26 and 28-30) at varying rates of speed. The apparatus may further include means for transporting a plurality of substrates through sputtering chambers (20, 26, 28) at variable velocities; means for reducing the ambient pressure within the sputtering chambers (20, 26, 28) to a vacuum level to enable sputtering operation; means for heating the substrates to a temperature conducive to sputtering coatings thereon providing a substantially uniform temperature profile over the surface of the substrates; and control means for providing control signals to and for receiving feedback input from, said sputtering chambers (20, 26, 28), means for transporting, means for reducing, and means for heating, the control means being programmable for allowing control over the means for sputtering, transporting, reducing and heating.

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APPARATUS AND METHOD FOR HIGH THROUGHPUT SPUTTERING

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BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to an apparatus and method for depositing multilayer thin films in a magnetron sputtering process. More particularly, the invention relates to an apparatus and method for depositing thin magnetic films for magnetic recording media in a high volume, electronically controlled, magnetron sputtering process, and to production of an improved magnetic recording disk product thereby.

2. Description of the Related Art

Sputtering is a well-known technique for depositing uniform thin films on a particular substrate. Sputtering is performed in an evacuated chamber using an inert gas, typically argon, with one or more substrates remaining static during deposition, being rotated about

the target (a "planetary" system) or being transported past the target (an "in-line" system).

Fundamentally, the technique involves bombarding the surface of a target material to be deposited as the film with electrostatically accelerated argon ions. Generally, electric fields are used to accelerate ions in the plasma gas, causing them to impinge on the target surface. As a result of momentum transfer, atoms and electrons are dislodged from the target surface in an area known as the erosion region. Target atoms deposit on the substrate, forming a film.

Typically, evacuation of the sputtering chamber is a two-stage process in order to avoid contaminant-circulating turbulence in the chamber. First, a throttled roughing stage slowly pumps down the chamber to a first pressure, such as about 50 microns. Then, high vacuum pumping occurs using turbo-, cryo- or diffusion pumps to evacuate the chamber to the highly evacuated base pressure (about 10^{-7} Torr) necessary to perform sputtering. Sputtering gas is subsequently provided in the evacuated chamber, backfilling to a pressure of about 2-10 microns.

The sputtering process is useful for depositing coatings from a plurality of target materials onto a variety of substrate materials, including glass, nickel-phosphorus plated aluminum disks, and ceramic materials. However, the relatively low sputtering rate achieved by the process solely relying on electrostatic forces (diode sputtering) may be impracticable for certain commercial applications where high volume processing is desired. Consequently, various magnet arrangements have been used to enhance the sputtering rate by trapping electrons close to the target surface, ionizing more argon, increasing the probability of impacting and

dislodging target atoms and therefore the sputtering rate. In particular, an increased sputtering rate is achieved by manipulation of a magnetic field geometry in the region adjacent to the target surface.

Sputter deposition performed in this manner is generally referred to as magnetron sputtering.

The magnetic field geometry may be optimized by adjusting the polarity and position of individual magnets used to generate magnetic fields with the goal of using the magnetic field flux paths to enhance the sputtering rate. For example, U.S. Patent No. 4,166,018, issued August 28, 1989 to J. S. Chapin and assigned to Airco, Inc., describes a planar direct current (d.c.) magnetron sputtering apparatus which uses a magnet configuration to generate arcuate magnetic flux paths (or lines) that confine the electrons and ions in a plasma region immediately adjacent to the target erosion region. A variety of magnet arrangements are suitable for this purpose, as long as one or more closed loop paths of magnetic flux is parallel to the cathode surface, e.g., concentric ovals or circles.

The role of the magnetic field is to trap moving electrons near the target. The field generates a force on the electrons, inducing the electrons to take a spiral path about the magnetic field lines. Such a spiral path is longer than a path along the field lines, thereby increasing the chance of the electron ionizing a plasma gas atom, typically argon. In addition, field lines also reduce electron repulsion away from a negatively biased target. As a result, a greater ion flux is created in the plasma region adjacent to the target with a correspondingly enhanced erosion of target atoms from an area which conforms to a shape approximating the inverse shape of the field lines.

Thus, if the field above the target is configured in arcuate lines, the erosion region adjacent to the field lines conforms to a shallow track, leaving much of the target unavailable for sputtering.

Even lower target utilization is problematic for magnetic targets because magnetic field lines tend to be concentrated within, and just above, a magnetic target. With increasing erosion of the magnetic target during sputtering, the field strength above the erosion region increases as more field lines 'leak' out from the target, trapping more electrons and further intensifying the plasma close to the erosion region. Consequently, the erosion region is limited to a narrow valley.

In addition to achieving high film deposition rates, sputtering offers the ability to tailor film properties to a considerable extent by making minor adjustments to process parameters. Of particular interest are processes yielding films with specific crystalline microstructures and magnetic properties. Consequently, much research has been conducted on the effects of sputtering pressures, deposition temperature and maintenance of the evacuated environment to avoid contamination or degradation of the substrate surface before film deposition.

Alloys of cobalt, nickel and chromium deposited on a chromium underlayer (CoNiCr/Cr) are highly desirable as films for magnetic recording media such as disks utilized in Winchester-type hard disk drives. However, on disk substrates, in-line sputtering processes create magnetic anisotropies which are manifested as signal waveform modulations and anomalies in the deposited films.

Anisotropy in the direction of disk travel through such in-line processes is understood to be caused by

crystalline growth perpendicular to the direction of disk travel as a result of the deposition of the obliquely incident flux of target atoms as the disk enters and exits a sputtering chamber. Since magnetic film properties depend on crystalline microstructure, such anisotropy in the chromium underlayer can disrupt the subsequent deposition of the magnetic CoNiCr layer in the preferred orientation. The preferred crystalline orientation for the chromium underlayer is with the closely packed, bcc {110} plane parallel to the film surface. This orientation for the chromium nucleating layer forces the 'C' axis of the hcp structure of the magnetic cobalt-alloy layer, i.e., the easy axis of magnetization, to be aligned in the film plane. Similarly, the orientation of the magnetic field generated in the sputtering process may induce an additional anisotropy which causes similar signal waveform modulations. See, Uchinami, et al., "Magnetic Anisotropies in Sputtered Thin Film Disks", IEEE Trans. Magn., Vol. MAG-23, No. 5, 3408-10, Sept. 1987, and Hill, et al., "Effects of Process Parameters on Low Frequency Modulation on Sputtered Disks for Longitudinal Recording", J. Vac Sci. Tech., Vol. A4, No. 3, 547-9, May 1986 (describing magnetic anisotropy phenomena).

Several approaches have been taken to eliminate the aforementioned waveform modulation problems while enhancing magnetic properties in the coating, especially coercivity. For instance, U.S. Patent No. 4,816,127, issued March 28, 1989 to A. Eltoukhy and assigned to Xidex Corp., describes one means for shielding the substrate to intercept the obliquely incident target atoms. In addition, Teng, et al., "Anisotropy-Induced Signal Waveform Modulation of DC Magnetron Sputtered Thin Films", IEEE Trans. Magn., Vol. MAG-22, 579-581,

1986, and Simpson, et al., "Effect of Circumferential Texture on the Properties of Thin Film Rigid Recording Disks", IEEE Trans. Magn., Vol. MAG-23, No. 5, 3405-7, Sept. 1987, suggest texturizing the disk substrate surface prior to film deposition. In particular, the authors propose circumferential surface grooves to promote circumferentially oriented grain growth and thereby increase film coercivity.

Other approaches to tailoring film properties have focused on manipulating the crystalline microstructure by introducing other elements into the alloy composition. For example, Shiroishi, et al., "Read and Write Characteristics of Co-Alloy/Cr Thin Films for Longitudinal Recording", IEEE Trans. Magn., Vol. MAG-24, 2730-2, 1988, and U.S. Patent No. 4,652,499, issued March 24, 1987 to J. K. Howard and assigned to IBM, relate to the substitution of elements such as platinum (Pt), tantalum (Ta), and zirconium (Zr) into cobalt-chromium (CoCr) films to produce higher coercivity and higher corrosion resistance in magnetic recording films.

CoCr alloys with tantalum (CoCrTa) are particularly attractive films for magnetic recording media. For example, it is known in the prior art to produce CoCrTa films by planetary magnetron sputtering processes using individual cobalt, chromium and tantalum targets or using cobalt-chromium and tantalum targets.

Fisher, et al., "Magnetic Properties and Longitudinal Recording Performance of Corrosion Resistant Alloy Films", IEEE Trans. Magn., Vol. MAG 22, no. 5, 352-4, Sept. 1986, describe a study of the magnetic and corrosion resistance properties of sputtered CoCr alloy films. Substitution of 2 atomic percent (at.%) Ta for Cr in a Co-16 at.% Cr alloy (i.e., creating a Co-14 at.% Cr-2 at.% Ta alloy) was found to

improve coercivity without increasing the saturation magnetization. In particular, a coercivity of 1400 Oe was induced in a 400 Å film. In addition, linear bit densities from 8386 flux reversals/cm to 1063 flux reversals/cm (21300 fci to 28100 fci) were achieved at -3 dB, with a signal-to-noise (SNR) ratio of 30 dB. Moreover, corrosion resistance of CoCr and CoCrTa films was improved relative to CoNi films.

U.S. Patent No. 4,940,548, issued on August 21, 1990 to Furusawa, et al., and assigned to Hitachi, Ltd., discloses the use of Ta to increase the coercivity and corrosion resistance of CoCr (and CoNi) alloys. CoCr alloys with 10 at.% Ta (and chromium content between 5 and 25 at.%) were sputtered onto multiple layers of chromium to produce magnetic films with low modulation even without texturing the substrate surface and highly desirable crystalline microstructure and magnetic anisotropy.

Development of a high throughput in-line system to produce sputtered CoCrTa films with enhanced magnetic and corrosion-resistance properties for the magnetic recording media industry has obvious economic advantages.

Linear recording density of magnetic films on media used in Winchester-type hard disk drives is known to be enhanced by decreasing the flying height of the magnetic recording head above the recording medium. With reduced flying height, there is an increased need to protect the magnetic film layer from wear. Magnetic films are also susceptible to corrosion from vapors present even at trace concentrations within the magnetic recording system. A variety of films have been employed as protective overlayers for magnetic films, including rhodium, carbon and inorganic nonmetallic carbides,

nitrides and oxides, like silica or alumina. However, problems such as poor adhesion to the magnetic layer and inadequate wear resistance have limited the applicability of these films. U.S. Patent No. 4,503,125 issued on March 3, 1985 to Nelson, et al. and assigned to Xebec, Inc. describes a protective carbon overcoating for magnetic films where adhesion is enhanced by chemically bonding a sputtered layer of titanium between the magnetic layer and the carbon overcoating.

In the particular case of sputtered carbon, desirable film properties have been achieved by carefully controlling deposition parameters. For example, during the sputtering process, the amount of gas incorporated in the growing film depends on sputtering parameters like target composition, sputtering gas pressure and chamber geometry. U.S. Patent No. 4,839,244, issued on June 13, 1989 to Y. Tsukamoto and assigned to NEC Corp., describes a process for co-sputtering a protective graphite fluoride overlayer with an inorganic nonmetallic compound in a gaseous atmosphere which includes fluorine gas. U.S. Patent No. 4,891,114 issued on January 1, 1990 to Hitzfeld, et al., and assigned to BASF Aktiengesellschaft of Germany, relates to a d. c. magnetron sputtering process for an amorphous carbon protective layer using a graphitic carbon target.

As the wear-resistant layer for magnetic recording media, it is desirable that the carbon overlayer have a microcrystalline structure corresponding to high hardness. In other words, it is desirable during sputtering to minimize graphitization of carbon which softens amorphous carbon films. One means employed to moderate graphitization of sputtered carbon films is by incorporating hydrogen into the film. Such

incorporation may be accomplished by sputtering in an argon atmosphere mixed with hydrogen or a hydrogen-containing gas, such as methane or other hydrocarbons.

Magnetron sputtering processes have been developed which have been somewhat successful in achieving high throughput. For example, U.S. Patent Nos. 4,735,840 and 4,894,133 issued to Hedgcoth on April 5, 1988 and April 16, 1990, respectively, describe a high volume planar d. c. magnetron in-line sputtering apparatus which forms multilayer magnetic recording films on disks for use in Winchester-type hard disk technology. The apparatus includes several consecutive regions for sputtering individual layers within a single sputtering chamber through which preheated disk substrates mounted on a pallet or other vertical carrier proceed at velocities up to about 10 mm/sec (1.97 ft/min), though averaging only about 3 mm/sec (0.6 ft/min). The first sputtering region deposits chromium (1,000 to 5,000 Å) on a circumferentially textured disk substrate. The next region deposits a layer (200 to 1,500 Å) of a magnetic alloy such as CoNi. Finally, a protective layer (200 to 800 Å) of a wear- and corrosion-resistant material such as amorphous carbon is deposited.

The apparatus is evacuated by mechanical and cryo pumps to a base pressure about 2×10^{-7} Torr. Sputtering is performed at a relatively high argon pressure between 2 and 4×10^{-2} Torr (20 to 40 microns) to eliminate anisotropy due to obliquely incident flux.

In optimizing a sputtering process to achieve high throughput, consideration should be given to other time-influenced aspects of the process apart from the sputtering rate. For example, substrate heating is typically accomplished with heaters requiring an extended dwell time to warm substrates to a desired

equilibrium temperature. In addition, substrate transport speeds through the sputtering apparatus have been limited with respect to mechanisms using traditional bottom drive, gear/belt-driven transport systems. Such bottom drive systems generally have intermeshing gears and may be practically incapable of proceeding faster than a particular rate due to rough section-to-section transitions which may dislodge substrates from the carrier and/or create particulate matter from gear wear which contaminates the disks prior to or during the sputtering process. Thus, overall process throughput would be further enhanced by the employment of heating and transport elements which require minimal time to perform these functions.

Generally, prior art sputtering devices utilize relatively unsophisticated means for controlling the sputtering processes described therein. Such control systems may comprise standard optical or electrical metering monitored by a system operator, with direct electrical or electro-mechanical switching of components utilized in the system by the system operator. Such systems have been adequately successful for limited throughput of sputtered substrates. However, a more comprehensive system is required for higher throughput sputtering operations. Specifically, a control system is required which provides to the operator an extensive amount of information concerning the ongoing process through a relatively user-friendly environment. In addition, the control system must adequately automate functions both in series and in parallel where necessary to control every aspect of the sputtering system. Further, it is desirable to include within such a control system the capability to preset a whole series of operating parameters to facilitate rapid set-up of

the system for processes employing myriad sputtering conditions.

SUMMARY OF THE INVENTION

Thus, an object of the present invention is to provide a high throughput sputtering process and apparatus.

A further object of the present invention is to provide a control system for the apparatus and process which continuously monitors and facilitates alteration of film deposition process parameters.

A further object of the present invention is to provide a high throughput sputtering apparatus with a centralized electronic control system.

An additional object of this invention is to provide the above objects in a means by which sputtering is achieved in a highly efficient, contaminant-free environment.

An additional object of this invention is to provide a highly versatile, contaminant-free means for transporting substrates through the apparatus and process.

A further object of this invention is to transport substrates through the sputtering apparatus by means of an overhead, gearless transport mechanism.

A further object of this invention is to provide a transport mechanism for carrying a plurality of substrates, each at a user-defined, variable speed.

A further object of this invention is to maintain a contaminant-free environment within the sputtering apparatus by means of a high speed, high capacity vacuum pump system.

A further object of this invention is to provide a magnetron design allowing efficient erosion of target material during the sputtering process.

A further object of this invention is to provide a high throughput sputtering apparatus which achieves and maintains a uniform substrate surface temperature profile before film deposition.

A further object of this invention is to provide a highly isotropic film by minimizing deposition by target atoms impinging on the substrate surface at high angles of incidence.

A further object of this invention is to provide high throughput sputtering apparatus which minimizes oxidation of the chromium underlayer before magnetic film deposition.

An additional object of the present invention is to provide high quality thin magnetic films on magnetic recording media with superior magnetic recording properties.

A further object of this invention is to provide high quality thin cobalt-chromium-tantalum (CoCrTa) films with superior magnetic recording properties.

A further object of this invention is to provide high quality sputtered thin magnetic films circumferentially oriented along the easy magnetic axis.

A further object of this invention is to provide high throughput sputtering apparatus for high quality thin carbon films with superior wear, hardness, corrosion and elastic properties.

A further object of this invention is to provide a method for depositing wear-resistant carbon films comprising sputtering in the presence of a hydrogen-containing gas.

A further object of this invention is to provide an improved method for sputtering carbon films using either an electrically biased or grounded pallet.

These and other objects of the invention are accomplished in a high throughput sputtering apparatus and process capable of producing sputtered substrates at a rate of up to five times greater than the prior art. An apparatus in accordance with the present invention provides a single or multi-layer coating to the surface of a plurality of substrates. Said apparatus includes a plurality of buffer and sputtering chambers, and an input end and an output end, wherein said substrates are transported through said chambers of said apparatus at varying rates of speed such that the rate of speed of a pallet from said input end to said output end is a constant for each of said plurality of pallets. A high throughput sputtering apparatus having a plurality of integrally matched components in accordance with the present invention may comprise means for sputtering a multi-layer coating onto a plurality of substrates, said means for sputtering including a series of sputtering chambers each having relative isolation from adjacent chambers to reduce cross contamination between the coating components being sputtered onto substrates therein, said sputtering chambers being isolated from ambient atmospheric conditions; means for transporting said plurality of substrates through said means for sputtering at variable velocities; means for reducing the ambient pressure within said means for sputtering to a vacuum level within a pressure range sufficient to enable sputtering operation; means for heating said plurality of substrates to a temperature conducive to sputtering said multi-layer coatings thereon, said means for heating providing a substantially uniform

temperature profile over the surface of said substrate; and control means for providing control signals to and for receiving feedback input from, said means for sputtering, means for transporting, means for reducing and means for heating, said control means being programmable for allowing control over said means for sputtering, means for transporting, means for reducing and means for heating.

A process in accordance the present invention includes: providing substrates to be sputtered; creating an environment about said substrates, said environment having a pressure within a pressure range which would enable sputtering operations; providing a gas into said environment in a plasma state and within said pressure range to carry out sputtering operations; transporting substrates at varying velocities through said environment a sequence of sputtering steps within said environment and along a return path external to said environment simultaneously introducing the substrates into said environment without substantially disrupting said pressure of said environment, providing rapid and uniform heating of said substrates to optimize film integrity during sputtering steps, and sputtering said substrates to provide successive layers of thin films on the substrates; and, removing the sputtered substrates without contaminating said environment.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be better understood by reference to the figures of the drawings wherein like numbers denote like parts throughout and wherein:

Figure 1 is a system plan view of the sputtering apparatus of the present invention.

Figure 2 is a cross sectional view along line 2-2 of the sputtering apparatus of the present invention as shown in Figure 1.

Figure 3 is a plan view of the sputtering apparatus of the present invention illustrating the physical relationship of the power supply and pumping subsystem components.

Figure 4 is an overview block diagram of the sputtering process of the present invention.

Figure 5 is a simplified perspective view of the means for texturing disk substrates used in the process of the present invention.

Figure 6 is a cross sectional view along line 6 - 6 of the cam wheel utilized in the means for texturing shown in Figure 5.

Figure 7 is a sectional magnified view of the texturing of a disk surface provided by the means for texturing disclosed in Figure 5.

Figure 8 is a surface view of one embodiment of a pallet for carrying disks through the sputtering apparatus of the present invention.

Figure 9 is a partial, enlarged view of the pallet of Figure 8.

Figure 10 is a partial, enlarged view of one region for carrying a disk in the pallet of Figure 9.

Figure 11 is a cross sectional view along 11 - 11 of the disk carrying region shown in Figure 10.

Figure 12 is an overview diagram of the pumping system used with the apparatus of the present invention.

Figure 13 is a side, partial cutaway view of a sputtering chamber utilized in the apparatus of the present invention.

Figure 14 is an assembled cross sectional view of the substrate transport mechanism, sputtering

shields, and pallet viewed along line 14 - 14 of Figure 13.

Figure 15 is a cross sectional view of the main (or "dwell") heating lamp assembly and chamber.

Figure 16 is a view of the main heating lamp assembly along line 16 -16 in Figure 15.

Figure 17 is a view of the main heating lamp mounting tray and cooling lines along line 17 - 17 in Figure 15.

Figure 18 is a cross sectional view of the secondary (or "passby") heating lamp and chamber assembly.

Figure 19 is a view of the heating lamp assembly along line 19 - 19 in Figure 18.

Figure 20 is a view of the secondary heating lamp, mounting tray and cooling lines along line 20 - 20 in Figure 18.

Figure 21 is a perspective, partial view of a heat reflecting panel, pallet, and substrate transport system utilized in the apparatus present invention.

Figure 22 is a perspective, exploded view of a portion of a pallet, substrate transport mechanism, sputtering shield, and cathode assembly utilized in the sputtering apparatus of the present invention.

Figure 23 is a top view of the sputtering chamber shown in Figure 13.

Figure 24 is a cross-sectional, side view along line 24 - 24 of Figure 23.

Figure 25 is a partial perspective view of a first surface of the cathode portion of the magnetron of the present invention.

Figure 26 is a perspective view of a second surface of the cathode of the magnetron of the present

invention, including cooling line inputs and magnet channels of the cathode.

Figure 27A is a cross-sectional, assembled view of a first embodiment of the magnet configuration in the cathode for a nonmagnetic target of the present invention along line 27 - 27 of Figure 25.

Figure 27B is a cross-sectional, assembled views of a second embodiment of the magnet configuration in the cathode for magnetic target of the present invention along line 27 - 27 of Figure 25.

Figure 28 is a cross sectional view of the multi-layer sputtered thin film created by the process of the present invention.

Figure 29 is a block diagram of the electronic control system of the present invention.

Figure 30 is a block flow chart of functional aspects of the software utilized in the process controller(s) of the present invention.

Figure 31 is a flow chart of the automated cryogenic pump regeneration process of the present invention.

Figures 32A through 32D comprise a single logical flow diagram outlining the software logic controlling the motor assemblies, load lock and exit lock pumping, and heater power during the automatic substrate run mode of the software utilized in the electronic control system of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

A. Introduction

Described herein is an apparatus and method for applying multilayer thin films to a substrate. The apparatus of the present invention is capable of applying the multilayer coatings to any given substrate

within a time frame of approximately five minutes. The apparatus and process may provide production throughputs on the order of at least five times greater than those of prior art multi-layer coating processes.

Other advantages of the sputtering apparatus and method for high throughput sputtering include: flexibility with respect to the composition of the multilayer films applied and the types of substrates to which they are applied; easily interchanged coating components; a novel means for heating substrates; a novel sputtering magnetron design; a variable speed, overhead, noncontaminating substrate transportation system; and a comprehensive, centralized, programmable electronic means for controlling the apparatus and process. In addition, when the process and apparatus are used for providing magnetic coatings for substrates, such as disks, to be utilized in hard disk drives using Winchester-type technology, also disclosed herein are: a unique disk texturing method for improving the disk's magnetic recording properties, and a novel disk carrier (or pallet) design which contributes to uniform substrate heating characteristics in a large, single, high capacity pallet.

The high throughput process and apparatus of the present invention accomplishes the objectives of the invention and provides the above advantages by providing a comprehensive in-line sputtering system utilizing matched component elements to process multiple large single sheet or pallet transported discrete substrates in a continuous, variable speed, sputtering process wherein each substrate has a start-to-finish process time which is relatively constant. Such an apparatus and method can process up to 3,000 95mm disk substrates, and 5,300 65mm disk substrates, per hour. In the disk

drive industry where cost savings per disk on the order of a few cents are a distinct advantage, the system manufactures 95mm disk substrates at a cost of $8.00 per disk as opposed to $12.00 per disk for other sputtering apparatus. Crucial to this process and apparatus are matching and optimizing such elements as disk preparation, including texturing and cleaning, provision of a sputtering environment with a sputtering apparatus, through an optimal vacuum pump system, transporting disk substrates through the sputtering environment in a high volume, high speed, contaminant-free manner without disturbing the sputtering environment, heating the substrates within the environment to optimal thermal levels for sputtering, and sputtering the substrates through a series of substantially isolated, non-crosscontaminating sputtering steps.

In general, application of multilayer films to a substrate involves two basic steps: preparation of the substrate and film deposition. Figure 4 represents a general overview of the process for applying thin films to a disk substrate according to the present invention. In particular, Figure 4 outlines the process steps for providing a single or multilayer film on a substrate, for example, a nickel-phosphorus plated aluminum disk for use in Winchester-type hard disk drives. It will be recognized by those skilled in the art that the steps outlined in Figure 4 may be modified, as required, depending on the particular type of substrate to be coated or thin film to be applied.

Substrate preparation process 410 of Figure 4 includes: kitting process 412; disk texturing process 414, disk precleaning 416; water rinse 418; ultrasonic cleaning with caustic cleaner 420; a sponge scrubbing in water 422; an ultrasonic cleaning in hot deionized water

424; scrubbing and deionizing water spray rinse 426; overflow deionized water rinse 428; ultrasonic cleaning of the disks with warm FREON TES 430; a cool FREON TES rinse 432; and vapor displacement drying in warm FREON TES 434. Each of the aforementioned steps outlined in Figure 4 is discussed in further detail in Section C of the specification.

Subsequent to the substrate preparation process 410, the clean, dry disk substrates may be provided to pallet loading process 450, wherein the disk substrates are provided to a substrate carrier which transports the disk substrates through coating process 460.

In coating process 460, disk substrates are provided to a coating apparatus, such as sputtering apparatus 10 shown in Figures 1 and 2, for provision of single or multilayer film thereon. The steps involved in coating process 460, such as in, for example, sputtering apparatus 10 of the present invention, involve: a system evacuation process 472 wherein specific chambers of the sputtering system are evacuated to a pressure of approximately 10^{-7} Torr and backfilled with a suitable sputtering gas, such as argon; a substrate heating process 476, wherein the substrates are raised to a temperature conducive to optimal film deposition; and a sputtering process 478 wherein the films are deposited on the substrates. Subsequently, the substrates are provided to an unload process 480. A process for transporting pallets 474 provides means for transporting the substrates through the above processes.

Each of the aforementioned steps with respect to applying the multilayer films to the substrates is discussed below in detail in separate sections of this specification.

B. Sputtering Apparatus Overview

Sputtering apparatus 10, used to apply a single or multilayer film to one or more substrates, will be discussed generally with reference to Figures 1A, 1B, 2A, 2B, and 3. Sputtering apparatus 10 provides a high throughput, in-line, magnetron sputtering process which allows reduced manufacturing costs per substrate by performing the coating sequence in a high volume manner. As will be discussed in detail below, single or multilayer film can be applied to a single side, or both sides, individually or simultaneously, of a single large sheet substrate, or to discrete substrates, such as disks mounted in a rack, pallet or other substrate carrier.

Generally, substrates are provided through multiple sputtering chambers 20, 26, 28 in apparatus 10 at a rate of speed, such as 3-6 feet/minute, and through heater chambers 14,16 and buffer chambers 12, 18, 22A-E, 24A-24C, 29 and 30, at a second rate of speed, such as 12 feet/minute. Through carefully matched elements, each of the substrates has a constant speed through apparatus 10.

Sputtering apparatus 10 includes seventeen (17) chamber modules 12-30 generally comprised of two basic types. A first type is configured for use as lock modules (12, 30), deposition process modules (20, 26, 28) or dwell modules (14, 18, 22A-22D and 29). A second type of module is configured for use as high vacuum buffer modules (16, 24A-24C) to provide process separation between deposition modules as discussed below.

Also shown in Figures 1 and 2 is substrate carrier return path 50 of the transport system of the present invention. Preferably, return path 50 is provided to

allow an ample number of substrate carriers to return from exit lock 30 for reuse in sputtering apparatus 10 in a continuous process, thereby reducing production delays and increasing overall process production speed. In addition, Figures 1 and 2 illustrate robotic pallet loading station 40 and robotic pallet unloading station 45, arranged along the transport system return path 50, for automatic loading and unloading, respectively, of the disk substrates into racks or pallets. As discussed in detail below, the substrate transport system utilizes a plurality of individual transport beam platforms, each including one or more optical or proximity position sensors, to move substrates through sputtering apparatus 10 and along return path 50, and to monitor the position of each substrate carrier within the transport system. Transfer speeds of the substrate carriers throughout the transport system may be adjustably varied from 0 to 24 ft/min. It should be noted that the upper limit of substrate carrier transport speed is constrained by the process limits of sputtering apparatus 10. Each individual drive stage (2200, discussed in Section F of this specification) is identical and thus has identical upper and lower speed limits.

Twelve (12) pneumatically operated doors D1-D12 are placed between specific chamber modules 12-30 of sputtering apparatus 10. Doors D1-D12 are located as generally represented in Figure 12 and are positioned as follows: door D1 isolates chamber 12 from the ambient environment; door D2 isolates load lock chamber 12 from main ("dwell") heating chamber 14; door D3 isolates main heating chamber 14 from first buffer-passby heating chamber 16; door D4 isolates buffer chamber 16 from first dwell chamber 18; doors D5-D6 isolate second buffer chamber 24A from third dwell

chamber 22B; doors D7-D8 isolate third buffer chamber 24B from fifth dwell chamber 22D; doors D9-D10 isolate fourth buffer chamber 24C from exit buffer 29; door D11 isolates exit buffer chamber 29 from exit lock chamber 30; and door D12 isolates exit lock chamber 30 from the ambient environment.

With reference to Figures 1-3 and 12, the general arrangement of chamber modules 12-30 will be hereinafter discussed. Load lock chamber 12 is essentially an isolation chamber between the ambient environment and chambers 14-29 of sputtering apparatus 10. Load lock chamber 12 is repeatedly evacuated between a pressure of approximately 50 mTorr and vented to ambient atmospheric conditions. Generally, sputtering within apparatus 10 takes place in an evacuated environment and chambers 16-29 are evacuated to the pressure of approximately 10^{-7} Torr, before argon gas is allowed to flow into the chambers to achieve a suitable sputtering pressure. Load lock chamber 12 is constructed of one-inch thick type 304 stainless steel and has a width W_1 of approximately 39 inches, length L_1 of approximately 49 inches, and a depth D_1 of approximately 12 inches as measured at the exterior walls of the chamber. The use of electropolished stainless steel in load lock chamber 12 and all other chambers in apparatus 10 minimizes particulate generation from scratches and other surface imperfections. Chambers 14, 18, 20, 22A-22D, 24A-24C, 26 and 28-30 have roughly the same dimensions. The internal volume of load lock chamber 12 is reduced to approximately three cubic feet by the installation therein of volume-displacing solid aluminum blocks bolted to the chamber door and rear wall (not shown) to facilitate faster evacuation times. Pump-down of load

lock chamber 12, and sputtering apparatus 10 in general, is discussed below in Section F of the specification.

After door D1 is pneumatically operated to allow a single large substrate or pallet to enter load lock chamber 12 at the initiation of processing by sputtering apparatus 10, load lock chamber 12 will be evacuated to a pressure of 50 microns (50 mTorr). Chambers 16-29 will have been evacuated to a base pressure of about 10^{-7} Torr and then backfilled with argon to the sputtering pressure (approximately 9-12 mTorr) prior to the entrance of a substrate into load lock chamber 12. Chamber 14 will have been evacuated previously to a pressure of approximately 10^{-5} - 10^{-7} Torr. Load lock chamber 12 is thus mechanically evacuated and pressurized at a level intermediate to that of chambers 14-29, and external ambient pressures, to provide isolation for the downstream sputtering processes occurring in chambers 14-29.

Dwell heating chamber 14 serves two functions: it acts as an entrance buffer between load lock chamber 12 and the internal sputtering environment in chambers 16-29; and it serves as a heating chamber for increasing the substrate temperature to optimize film deposition. Chamber 14 includes eight banks of quartz lamp heating elements, four banks mounted to outer door 114 and four banks mounted opposite thereof on rear chamber wall 99. Door D2, separating load lock chamber 12 and dwell heating chamber 14, is a high vacuum slit valve. Details of the heating banks located in dwell heating chamber 14 are discussed in Section H of this specification.

During processing of a substrate, dwell heating chamber 14 is pumped to a pressure of approximately

10^{-5} - 10^{-7} Torr before the substrate present in load lock chamber 12 is allowed to pass into dwell heating chamber 14. A pressure of 10^{-5} - 10^{-7} Torr helps eliminate the effects of outgassing from the substrate in dwell heating chamber 14. Subsequently argon backfilling is provided to raise the pressure to approximately 9-12 mTorr, equalizing the environment in dwell heating chamber 14 with that in chambers 16-29. The substrate may thereafter remain in dwell heating chamber 14 for the duration of time necessary for the exposure of the substrate to the lamps to have its desired effect.

First buffer-passby heating chamber 16 is a chamber module of the second type having a width W_2 of approximately 26 inches by a height H' of approximately 49 inches by a depth D' of approximately 12 inches. In general, buffer chambers 16 and 24A-C are positioned between dwell chambers 18A and 22A-D to separate the ongoing sputtering processes within apparatus 10, thereby reducing cross-contamination of coating components.

First buffer-passby heating chamber 16 includes a heating assembly comprising ten banks of quartz lamp heating elements, five mounted to outer door 116 and five to the rear chamber 100 wall opposite thereof. Passby heating chamber 16 is designed to insure uniform substrate temperature prior to film deposition. The structure of the passby heating assembly is discussed in detail in Section H of this specification.

Three coating modules -- chromium deposition chamber 20, magnetic deposition chamber 26, and carbon deposition chamber 28 -- having dimensions roughly equal to those of load lock chamber 12 and constructed of type 304 electropolished stainless steel, may be utilized to sputter single or multilayer films on a substrate

passing through apparatus 10. Four pairs of d. c. magnetron sputtering cathodes are mounted, four magnetrons per door, on doors 120-1, 120-2, 126-1, 126-2, 128-1, and 128-2 on both sides of each chamber 20, 26, and 28, respectively. Target materials are mounted to cathodes 2222-2225. Anodes 2338, gas manifolds 2323, and shielding 2230, 2236, 2238 and 2240 are also attached to outer doors 120-1, 120-2, 126-1, 126-2 and 128-1, 128-2. Mounting these components to the doors facilitates target changes and chamber maintenance. Further, conduits (not shown) for power, cooling, and process gases are provided in outer doors 120, 126, 128. Feedthrough conduits are also provided in doors 112, 114, 116, 118, 122A-122E, 124A-124C, 129, and 130 to allow for modification of the sputtering apparatus 10. Details of deposition chambers 20, 26 and 28 are provided in Section I of this specification.

Dwell chambers 18 and 22A-22E are manufactured to have the same dimensions as load lock chamber 12 and provide separation between the buffer modules and the deposition chambers. Dwell modules 18 and 22A-22E allow for substrate transport system runout, if necessary, during multiple substrate processing in sputtering apparatus 10. If desired, additional heating assemblies may be provided in any or all of dwell modules 22A-22E.

Exit buffer module 29 is essentially identical to dwell heating chamber 14, without the dwell heating assembly hardware. Exit buffer module 29 provides a buffer area to facilitate removal of pallets or substrates from sputtering apparatus 10 to exit lock chamber 30 and further isolates the sputtering process from the external environment.

Exit lock chamber 30 is essentially identical to load lock chamber 12 and operates in reverse pumping

order, allowing pallets or substrates to be transferred from the evacuated environment of sputtering apparatus 10, to the ambient external environment.

Optimally, sputtering apparatus 10 can simultaneously process up to seven large single sheet substrates or pallets carrying smaller substrates, such as disks. When seven such substrates are simultaneously processed in sputtering apparatus 10, one such substrate is positioned in each of seven chambers, for example, as follows: load lock chamber 12; dwell heating chamber 14; chromium deposition chamber 20; magnetic deposition chamber 26; carbon deposition chamber 28; exit buffer chamber 29; and exit lock chamber 30. The sheer dimensions of sputtering apparatus 10 allow for a plurality of large single sheet substrates, and a plurality of high capacity discrete substrate carrying pallets, or both, to be simultaneously processed. The problems attending the development of such a large scale, high throughput sputtering apparatus, and the solutions adopted, are discussed herein.

Chambers 12-30 are mounted on steel assembly rack 150. Rack 150 includes channels 55 which preferably are used to mount components used with sputtering apparatus 10, such as those used in the electronic control system. It will be understood by those skilled in the art that any suitable arrangement for mounting chambers 12-30 may be made within contemplation of the present invention.

C. Substrate Preparation

Various materials in the form of large single sheet or discrete substrates may be coated in sputtering apparatus 10. Suitable substrates include polished nickel-phosphorus plated aluminum disks, ceramic disks (available from Kyocera Industrial Ceramics Corporation,

Los Angeles, California, or Corning Glass Corporation, Corning, New York), glass substrates (available from Pilkington Corporation Microelectronics, Ltd., Toledo, Ohio, Nederlandse Philips Bedrijven B.V., The Netherlands, or Glaverbel Corporation Data Storage Glass Products, Belgium), or carbon substrates or graphite substrates (Kao Corporation of Japan). The process and apparatus disclosed herein is discussed with regard to preparation and sputtering of polished nickel-phosphorus plated aluminum substrates, such as disks suitable for use in Winchester-type hard disk drives. As will be understood by those skilled in the art, the system is readily adaptable for use with other types of single sheet or discrete substrates as discussed above.

1. Kitting

In general, polished nickel-phosphorus plated aluminum disks or similar substrates utilized in the manufacture of magnetic recording media for Winchester-type hard disk drives, such as those available from Mitsubishi Corporation or Seagate Corporation, are shipped to magnetic media manufacturers in standard ribbed or slotted shipping cassettes, 25 substrates per cassette. Transfer of the substrates from the shipping cassettes to process cassettes, used in processing the disks through texturing process 414 and up through pre-cleaning process 416, is known as kitting. Kitting must occur in a class 10,000 clean room environment and is generally performed manually.

2. Texturing

It is well known in the art that circumferential texturing or abrading of a substrate surface can cause the hcp "C" axis of a magnetic cobalt-alloy film to

orient in a circumferential direction, and thereby supply a more intense and uniform read/back signal to a flying read/write head in a Winchester-type hard disk drive. Texturing the disk substrate also affects the glide properties of the read/write read. Obviously, the texture of the disk surface also provides a limit to the minimum flying height of the read/write head. Texturing of the substrate also prevents stiction which may result should the head land on a smooth, planar area of the disk, thereby resulting in a job-blocking effect, rendering it almost impossible to remove the stuck read/write head from the disk surface, and rendering a disk drive entirely inoperable.

Texturing generally takes place in a class 1,000 clean room and, as previously discussed, any number of well-known methods may be used.

In the preparation of substrates to be coated within sputtering apparatus 10, a plurality of texturing machines, such as Exclusive Design Company's EDC Model C texturing machine, (EDC, 914 South Clairmont, San Mateo, California 94402) are used. A novel modification to each EDC texturing machine provides a unique, diamond-shaped texturing effect. A portion of a disk surface having such texturing is illustrated in Figure 7.

With reference to Figures 5 through 7, texturing process 414 will be hereinafter described in relation to the texturing of discrete disk substrates 510 suitable for use in sputtering apparatus 10.

Figure 5 is a general disclosure of the texturing portion 500 of texturing machine M.

Generally, texturing of disk substrate 510 is performed using two loops of fixed abrasive tape 515 which are stretched about rubber rollers 520-1, 520-2.

Abrasive tape 515 for each roller 520 is provided by two reels, one supply reel and one take-up reel (not shown), in a single feed direction with a portion of abrasive tape 515 looped about rollers 520. Abrasive tape 515 makes only one transition from the supply reel to the take-up reel during a normal texturing cycle. Rollers 520-1 and 520-2 rotate about spindles 522-1 and 522-2, respectively, mounted to oscillation arm 525 of machine M.

A second set of rubber rollers 530-1, 530-2, and associated supply and take-up reels, (not shown), allow for mounting a fine cloth tape 535 to remove excess particulate matter generated by abrasive tape 515 as disk 510 is texturized. Like abrasive tape 515, cloth tape 535 is used only once from supply reel to take-up reel.

Cam assembly 550 causes arm 525, rollers 520-1, 520-2, and abrasive tape 515 to oscillate in the direction of axis X. Cam assembly 550 includes cam wheel 600 fixed by two set screws (not shown) to spindle 560 which is rotated in a counterclockwise direction about axis Y_1 by machine M. Cam wheel 600 contacts first and second rollers 570, 575, rotatably mounted to support members 572, 574, respectively, to translate the motion defined by rotation of cam wheels 600 to oscillation arm 525.

In operation, disk substrate 510 is mounted on spindle 540 of machine M and rotated in a clockwise direction about axis Y_2 passing through the center of spindle 540. To mount a disk substrate 510, machine M causes rollers 520 and 530 to linearly separate in opposing directions along paths parallel axes Y_{1-2} allowing disk substrate 510 to be inserted and removed by an automatic loading apparatus (not shown) onto spindle 540. Disk substrate 510 is then rotated about

axis Y_2 in a clockwise direction. Simultaneously thereto, abrasive tape 515 and cloth tape 535 are rotated about rollers 520-1, 520-2 and 530-1, 530-2, respectively, such that rollers 520-2 and roller 530-1 rotate in a clockwise direction, and rollers 520-1 and 530-2 rotate in a counterclockwise direction. Thus, opposing rollers 520-1, 520-2 and 530-1, 530-2 rotate in directions opposite to each other and in a direction opposing the direction of rotation of disk substrate 510, to provide optimal disk texturing and cleaning. As rollers 520 and 530 are rotated, machine M simultaneously rotates spindle 560, and hence cam wheel 600, causing rollers 520 to oscillate about axis X.

As a result of the unique shape cam wheel 600, discussed with reference with Figures 6A-6B, a novel cross-hatched type texturing 700 results. With reference to Figure 7, texturing process 414, discussed above, generally forms diamond-shaped areas 750 defined by a plurality of crossing texture lines 740 provided to a depth of 60 μm. When lines 740 intersect, they define a plurality of angles θ in a range of approximately 6 to 10 degrees. It has been determined that an angle greater than 10 degrees, while providing generally excellent properties of low dynamic friction and low stiction, results in problems with the magnetic recording properties such as bit dropouts or shifts in areas adjacent to intersecting texturing lines. To compensate, a higher coercivity alloy is required on the substrate. These problems are within acceptable levels when angle θ is within a range of 4°-10°. An angle of 6 degrees or less improves the magnetic recording capability of the record media, but sacrifices in stiction and running friction properties of the disk are made for θ less than 6 degrees. Preferably, when

rotation Y_1 of cam wheel 600 is approximately 6 Hertz, angles θ of approximately 6° will result.

The structure of cam wheel 600 is detailed in Figure 6A and 6B. Figure 6A shows cross-section cam wheel 600 along line 6-6 in Figure 5. Cam wheel 600 has a shape wherein the radial distance R between axis Y_1 and outer edge 710 is at a minimum distance R1 at reference point 720, and at a maximum distance R2 at point 730, 180° opposite point 720.

Currently, two types of cams are used in the machine M for texturing disk substrates 510, depending on the size of disk substrate 510. In one embodiment, the distance R2 equals one inch and distance R1 = .760 inch. Figure 6B illustrates the distance of all points along outer edge 710 from axis Y_1. As can be seen therein, radial distance R from outer diameter 710 to axis Y1 is evenly sloped from the point 720 to point 730, of 180° opposite from point 720. Assuming a line from axis Y_1 to point 720 is used as a reference, the distance of all points along outer edge 710 from axis Y_1 in one embodiment is as follows: the distance R1 at point 720 = .756 inch, the distance at 60° and 300° angles from point 720 = .840 inch, the distance at 120° and 240° from point 720 = .920 inch, and the distance R2 at 180° from point 720 (point 730) = 1.00 inches.

In the above embodiment, cam wheel 600 may be manufactured by beginning with a completely circular cam wheel and removing outer edge 720 of cam wheel 600 in equal linear to rotational increments. For example, at point 730, no material is removed, moving 3 degrees to the left or right, the cutting device is adjusted to move in a distance toward axis Y_1 of approximately .004 inch, and is thereafter moved .004 inch closer to axis Y_1 for every 3° of rotational movement about axis

Y_1. In this manner, one embodiment of cam wheel 600 may be manufactured; those skilled in the art will recognize that various sizes and types of cam wheels may be manufactured in like manner for various sizes of disk substrates 510.

3. Disk Cleaning

Following texturing, the disk surface is cleaned to facilitate uniform film deposition, for example, by performing the following steps, represented as stage 416 in Figure 4.

During precleaning process 416, each disk surface is rubbed with a polyurethane soap pad. In an automated process, textured disk substrates are removed from process cassettes and placed in a precleaning machine such as the Model MDS1, commercially available from Speed Fam Corporation of Tempe, Arizona. In the Speed Fam machine described above, a plurality of disk substrates is arranged about a large pad assembly in a cylindrical tank, thereby allowing rapid disk cleaning (up to 350 95-mm disks per hour) by performing precleaning process 416 on a number of disk substrates simultaneously.

An additional preparation step involves taking disk substrates through a multi-staged cleaning process 435. This process is illustrated generally in Figure 4 as stages 418 through 434. Each stage, for example, may represent a separate tank process wherein all tanks are connected with a conveyor system. In addition, transfer between individual stages may be performed by robots.

Specifically, disk substrates 510 are rinsed in water at stage 418, followed by several ultrasonic cleaning stages (420, 424 and 430) and sponge scrubbing stages (422 and 426). The multistage cleaning process

435 processing stages include water rinse 418; ultrasonic cleaning with caustic cleaner 420; a sponge scrubbing in water 422; an ultrasonic cleaning in hot deionized water 424; ultrafiltered deionized water spray rinse 426; overflow deionized water rinse 428; ultrasonic cleaning of disk substrates with warm FREON TES 430; a cool FREON TES rinse 432; and vapor displacement drying in warm FREON TES 434.

Application of ultrasonic power is particularly useful in scouring the newly-applied fine cross-texturing grooves on the disk surface. Stages 420, 424 and 426 combine ultrasonic action in liquids with alkali and aqueous cleaning agents for thorough cleaning. Stage 430 combines ultrasonic action with a degreasing solvent like DuPont's FREON TES.

Multistage cleaning process 435 is preferably performed by a Speed Fam Model MD08 cleaning machine. The Speed Fam model MD08 with certain modifications, is suitable for performing this final cleaning process, to maintain the high level of substrate cleanliness prior to film deposition. Specifically, modifications to the Speed Fam MD08 machine include passivated stainless steel tanks and recirculation lines, brush materials such as polyvinylalcohol, and a highly efficient tank filtration system. In addition, standard process cassette rollers are replaced with highly wear-resistant plastics like DuPont's DELRIN polymethylene oxide. The process regimen 410, as illustrated by Figure 4, was found to be capable of handling approximately 550-750 disks per hour, using two Speed Fam model MDS1 polishing machines and one Speed Fam model MD08 cleaning machine. Higher processing rates would result with additional process hardware, but may be limited because of the

release of FREON TES, a chlorinated fluorocarbon, to the environment.

D. Pallet Design

A unique rack or "pallet" for carrying a number of discrete substrates such as disks utilized in Winchester-type hard disk technology will be discussed with reference to Figures 8-11.

Generally, a plurality of magnetic disk sizes are manufactured for Winchester-type hard disk drives; two of the most common include 65 mm and 95 mm diameter disks. It will be understood that the general principles of pallet 800, described herein with reference to a pallet for carrying 95 mm disks, are applicable for pallets equally capable of handling disk substrates of other sizes.

Pallet 800, shown in Figure 8, shows 56 substrate carrying regions 1000 for carrying 95 mm diameter disk substrates 510. A pallet designed to carry 65 mm diameter disk substrates has 99 substrate-carrying regions 1000. Pallet 800 may be manufactured from 6061-T6 aluminum, available from the Aluminum Corporation of America (Alcoa), Pittsburg, Pennsylvania or other suitable material. Pallet 800 has a height H'' of approximately 34.56 inches, a length L of approximately 31 inches, and a depth DD of approximately 0.25 inch. These dimensions reflect the maximum size pallets or single sheet substrates which may be utilized if sputtering apparatus 10 is made to have dimensions as discussed herein.

In utilizing pallets having the above-mentioned dimensions, several problems arise. Achieving a uniform temperature profile across the surface of the pallet is difficult, especially where thermal expansion of the

pallet material occurs at a different rate than that of disk substrates carried therein because of the pallet's greater thickness. Specifically, thermal expansion of the pallet material causes inherent warping of the pallet. Further, thermal expansion reduces the clearance within each substrate-carrying region 1000 around each disk substrate 510, constricting and warping disk substrates 510 undergoing their own thermal expansion, and ultimately precluding uniform film deposition. Addressing thermal expansion incompatibilities between the pallet and disk substrates is more than an issue of material selection. For a high throughput sputtering system, maximizing the substrate-carrying capacity of pallet 800 is equally desirable.

To minimize warping while maximizing the substrate-carrying capacity of pallet 800, substrate-carrying regions 1000 are arranged in a staggered, hexagonal fashion, providing the densest arrangement of disk substrates 510 within the established dimensions of pallet 800. As such, substrate-carrying regions 1000 are arranged in rows 810-880, wherein each substrate-carrying region 1000 in a particular row (e.g., 810) is offset from another substrate-carrying region 1000 in an adjacent row (e.g., 820) by a distance equalling one-half of the total horizontal width of each substrate-carrying region 1000.

In an effort to minimize thermal losses from disk substrates 510 to pallet 800, slots 890 and cavities 895 are provided. Cavities 895 in the lower portion of pallet 800 reduce the surface area of pallet 800 which is subject to thermal expansion, without reducing the substrate-carrying capacity of pallet 800 as the lower portion of pallet 800 does not carry disks beyond the extent of the sputtering flux. Notches 892 compensate

for nonuniform thermal expansion across pallet 800 as a result of nonuniform heating across the pallet surface. Specifically, notches 892 allow relatively unrestricted expansion of the edges of pallet 800, thereby avoiding pallet warping.

Reference notches 910 in pallet 800 are provided for use with robotic loading and unloading stations 40 and 45. Specific operation of these stations 40 and 45 is discussed in Section E of the specification.

With reference to Figures 10 and 11, details of disk substrate-carrying regions 1000 are hereinafter discussed. Each substrate-carrying region 1000 has a roughly circular orifice with an outer circumferential edge 1010 defined by a beveled edge 1015. Beveled edge 1015 reduces any shielding effect pallet 800 may have on disk substrate 510 mounted in substrate-carrying region 1000 during sputtering. Notch mounting groove 1020 in the lower half of region 1000 allows disk substrate 510 to be seated therein. Lip 1030, at the upper portion of substrate-carrying region 1000, allows manual insertion of disk substrates 510 into substrate-carrying regions 1000. As shown in Figure 10, lip 1030 defines a semi-circular arc 1035 having a radial distance from axis F of 1.9 inches in the 95 mm embodiment of pallet 800, shown in Figures 8-11. Inner edge 1040 is defined by one end of beveled edge 1015 and has a radial distance from axis G of approximately 1.859 inches. Groove 1020 likewise has a semi-circular shape and is positioned a radial distance of 1.883 inches from axis G. Groove 1020 has a depth D′ of approximately .012 inches.

In practice, disk substrate 510 is seated in groove 1020 and is securely held in place therein. During processing, pallet 800 is relatively stable and disk substrate 510 is securely maintained in substrate-

carrying region 1000. The radial distance between axis F and axis G is approximately 0.12 inch, and thus the radial distance between lip region arc 1035 and the base of groove 1020 is 3.903 inches, a distance which is greater than the diameter of a 95 mm disk (3.743 inches). This excess space facilitates disk loading and allows for thermal expansion of disk substrate 510 relative to the pallet 800 during the heating process.

It should be noted that pallet 800 may be passed through sputtering apparatus 10 many times before cleaning, especially of grooves 1020, is required to insure substrate-carrying security within substrate-carrying regions 1000. After approximately 100 production cycles, edge 1040 and groove 1020 must be cleaned due to buildup of deposited layers from constant sputtering in sputtering apparatus 10.

E. Substrate Loading

As discussed briefly with reference to Figure 1, disk substrates 510 may be provided in pallet 800 by means of an automatic loading process which preferably occurs at a point along transport system return path 50. Robotic loading station 40 is arranged to load disk substrates 510 into pallets 800 just prior to entrance of pallets 800 into load lock chamber 12. Robotic unloading station 45 is preferably positioned to remove disk substrates 510 from pallets 800 just after exit of pallets 800 from exit lock chamber 30.

In the automatic loading/unloading process of the present invention, an automatic pallet loading station 40 and an unloading pallet station 45 built by Intelmatic Corporation of Fremont, California are utilized. Each station uses three Adept Model One robots, controlled by Adept Model CC Compact Controllers

and an Elmo Controller operating under conventional control software, tailored for apparatus 10 by Intelmatic Corporation software for controlling the loading processing and sequencing pallet movement. Three robots 40-1, 40-2, 40-3 load pallets 800 in a top to bottom manner, with first robot 40-1 loading the top third of pallet 800, second robot 40-2 loading the middle third of pallet 800 and a third robot 40-3 loading the bottom third of pallet 800. Likewise, three robots 45-1, 45-2, 45-3 unload substrates from pallet 800 in a reverse order to that of robots 40-1, 40-2, 40-3. Specifically, robot 45-1 unloads the bottom third of pallet 800, robot 45-2 then unloads the middle portion of pallet 800 and finally robot 45-3 unloads the top third of pallet 800. Loading and unloading of pallets 800 in this manner ensures that no particulate matter present on pallet 800 or disk substrates 510 falls from the upper portion of pallet 800 to deposit on disk substrates 510 loaded in lower portions of pallet 800 during the loading or unloading process.

The Adept Model One robot and Intelmatic software utilize reference notches 910 in pallet 800 to locate the approximate center of each substrate-carrying region 1000. The Adept robots utilize a single finger-type loading mechanism which engages disk substrates 510 by protruding through the center of each disk substrate 510 and lifts and places disk substrates 510 into grooves 1020 within each substrate-carrying region 1000.

Automatic robots 40-1, 40-2, 40-3 and robots 45-1, 45-2, 45-3 in conjunction with the Intelmatic system, have the capability of loading and unloading, respectively, up to 2,500 disk substrates per hour. Sputtering apparatus 10 has a capability of producing 3,000 95mm thin magnetic film coated disks per hour.

Automatic loading and unloading stations 40, 45 thus represent constraints on production throughput for the present embodiment of the overall sputtering process discussed herein. As will be recognized by those skilled in the art, additional stations may be provided to increase production loading to match apparatus 10 throughput rates.

Pallet 800 may also be manually loaded and unloaded. In manual loading, lip 1030 is used to align the surface of disk substrate 510 with the planar surface of pallet 800 to more accurately provide disk 510 substrate into groove 1020.

F. Pumping System

Sputtering apparatus 10 incorporates a highly efficient, high capacity vacuum pump system, represented schematically in Figure 12. Preparing sputtering apparatus 10 to carry out the sputtering operation described by the present invention requires that the vacuum pump system achieve two purposes. First, the vacuum pump system must furnish a highly evacuated environment for substantially unobstructed paths between the bombarding species and the target surface, and between dislodged target species and the substrates. Second, the vacuum pump system must minimize contaminant circulation inside sputtering apparatus 10 in order to maintain high film integrity. These goals are achieved simultaneously by virtue of the design of the pumping system of the present invention.

The overall vacuum pump system comprises three mechanical or roughing pumps MP1-MP3, with blowers BL1-BL3, and twelve (12) cryo pumps, C1-C12 including seven 8-inch diameter pumps (C3, C4, C6, C7, C9, C10, and C12), four 10-inch diameter cryo pumps (C2, C5, C8, and

C11) for process isolation, and one 16-inch diameter cryo pump C1. A cryo pump model such as is available from CTI Cryogenics, a division of Helix Corporation of Santa Clara, California, is suitable for use in the pumping system of the present inventions. Eight compressors CY1-CY8 provide helium gas to cryo pumps C1-C12, with: CY1 supplying C1; CY2 supplying C2; CY3 supplying C3; CY4 supplying C5; CY5 supplying C4, C6 and C7; CY6 supplying C8; CY7 supplying C9, C10 and C12; and CY8 supplying C11.

The overall vacuum system also features a network of valves. Five chamber vent valves CV1-CV5 vent the internal environment of sputtering apparatus 10 to atmosphere. Roughing valves RV1-RV5 isolate mechanical pumps MP1-MP3 and blowers BL1-BL3 from sputtering apparatus 10. Chamber vent valves CV1-CV5 and roughing valves RV1-RV5 allow the apparatus 10 to be divided into five sections allowing each individual section to be vented and pumped down as desired, to facilitate maintenance of sputtering apparatus 10. (See Section K, <u>System Control Software</u>.) High vacuum valves HV1-HV12 isolate cryo pumps C1-C3 from apparatus 10 to allow controlled pump-down sputtering apparatus 10 from atmospheric pressure. Valves MP1IV-MP3IV isolate one or more of mechanical pumps MP1-MP3 from the pumping system conduits, allowing flexibility in the number of mechanical pumps operating at a given time. Cryo pump roughing valves CR1-CR12 control contamination out of cryo pumps C1-C12 during a cryopump regeneration.

In operation, mechanical pumps MP1-MP3 and blowers BL1-BL3 perform a pump-down of sputtering apparatus 10 from atmospheric pressure to a level of about 50 mTorr. During the pump-down, high vacuum valves HV1 through HV12 are closed, roughing valves RV1 through RV5 and

chamber isolation doors D2 through D11 are open and doors D1 and D12 are closed. Pumps MP1-MP3 and blowers BL1-BL3 evacuate sputtering apparatus 10 to a "crossover" point, which has been selected to be between about 50 microns to 150 microns (50 mTorr to 150 mTorr). When the internal pressure reaches the desired crossover point, the system operator, through the electronic control system, closes roughing valves RV1-RV5 and opens high vacuum valves HV1-HV12. Cryo pumps C1-C12, working in conjunction with compressors CY1-CY8, evacuate the system to about 10^{-5} to 10^{-8} Torr (0.01 microns to 1 x 10^{-5} microns). Argon gas flow is thereafter provided through gas manifolds 2323 into chambers 14-29 to a sputtering pressure about 9-12 mTorr (9-12 microns).

When a pallet 800 loaded with disk substrates 510 is ready to proceed into sputtering apparatus 10 through load lock chamber 12, chamber 12 is at atmospheric pressure, and chambers 14 through 29 are at about 10 mTorr (10 microns). Pallet 800 enters from a class 10,000 clean room environment where robotic loading station 40 is positioned. Because the clean room environment is more sterile than that of load lock chamber 12, nitrogen gas is provided through valve LLSWEEP and a vent valve (not shown) in load lock 30 is opened to create a positive outflow from the clean room into load lock chamber 12, prohibiting contaminants from entering the clean room's environment. Ceramic filters are also provided to trap particulate matter generated when nitrogen backfill is provided through LLSWEEP into load lock chamber 12. Sturdy filters, such as Membralox 0.01 micron sintered alumina filters, available from Aluminum Company of America (Alcoa) Separations Technology, Warrendale, Pennsylvania, resist flexing over many pumping cycles even at pressures higher than

2000 psi and thereby contribute to the maintenance of a contaminant-free environment within the sputtering apparatus.

After pallet 800 enters load lock chamber 12 and door D1 closes, mechanical pump MP2 and blower BL3 evacuate the load lock chamber 12 down to about 100 mTorr (100 microns). When the crossover point is reached, D2 opens, allowing pallet 800 to proceed into dwell heating chamber 14 where pallet 800 and disk substrates 510 will be preheated in preparation for film deposition. During the heating cycle, some outgassing from pallet 800 and disk substrates 510 occurs, particularly if pallet 800 has been recycled, i.e., has passed through sputtering apparatus 10 at least once without undergoing scheduled cleaning. The carbon remaining on pallet 800 acts as a sponge for water which may be absorbed from the atmosphere when pallet 800 is at any point along return path 50 from a previous sputtering run. Water outgassed (known as 'drag in') in dwell heating chamber 14 is removed from the internal environment of sputtering apparatus 10 by 16-inch cryo pump C1, evacuating dwell heating chamber 14 back down to about 10^{-5} Torr (0.01 microns). At this time, a pressure differential on the order of 10 microns (10 mTorr) exists between dwell heating chamber 14 and passby heating chamber 16. Because such a pressure differential can destabilize downstream sputtering processes, argon is used to backfill dwell heating chamber 14 in order to equalize the pressures, as monitored by Pirani gauge PIR2. Once this pressure differential is equalized, door D3 opens, permitting pallet 800 and disk substrates 510 to proceed into dwell chamber 18. A pump, such as model PFC-1000 from Polycold Systems of San Rafael, California, connected

into dwell chamber 18, removes any residual water outgassed from pallet 800 and disk substrates 510, following additional heating performed in passby heating chamber 16. Removal of this residual water is crucial to eliminate oxidation of the chromium target and underlayer in chromium sputtering chamber 20. Pallet 800 and disk substrates 510 continue through sputtering apparatus 10 and the sputtering operation proceeds as described in Section L.

After the multilayer film is deposited, pallet 800 and disk substrates 510 approach exit lock chamber 30 from exit buffer chamber 29. A pressure differential exists between chambers 29 and 30, on the order of that described in connection with dwell heating chamber 14 and passby heating chamber 16. Argon is used to backfill exit buffer chamber 29 to equalize pressures across door D11, as monitored by Pirani gauge PIR15. Once equalization is accomplished, door D11 opens, allowing pallet 800 with disk substrates 510 to proceed through exit lock chamber 30 and out of sputtering apparatus 10.

Periodically, cryo pumps C1-C12 must be cleaned in order to regenerate the cryogenic capacity of the pumps. More specifically, such cleaning involves clearing the cryo pumps of gases frozen therein. For sputtering apparatus 10, cryo pump regeneration typically takes place during machine down-time scheduled for replacing targets in sputtering chambers 20, 26 and 28.

The cryo pump regeneration process of the present invention is discussed more particularly in Section K of this specification. Generally, cryo pump regeneration is initiated by first closing off all of high vacuum pump valves HV1-HV12, opening roughing sieve valves SVIV1-SVI15 and turning on sieve heaters SVNTR1-SVNTR12,

mechanical pumps MP1-MP3 and blowers BL1-BL3. Simultaneously, warm nitrogen (N_2) is fed from supply N_2 through valves NIF1-NIF12 via heaters NIH1-NIH12 to cryo pumps C1-C12. The nitrogen flow defrosts frozen gases in pumps C1-C12 when C1-C12 reach 290°K, pump MP2 and blower BL2 discharge the contents to the atmosphere external to sputtering apparatus 10. Sieve traps SVIV1-SVIV12 and cryo roughing valves CR1-CR12 insure vapors from hydrocarbon pump oils used in the mechanical pumps do not backflow into and contaminate the internal sputtering environment during the regeneration process. By these means, disk substrates 510 already at various stages within the sputtering apparatus are protected from ambient contaminants accompanying subsequent pallets which enter the sputtering apparatus.

G. Transport Mechanism

With reference to Figures 1, 13, 14, and 24, a system for transporting substrates through sputtering apparatus 10 and along return path 50 utilized in the apparatus and process of the present invention, will be hereinafter described.

The transport system of the present invention utilizes a plurality of individually powered transport platforms 2400. Each transport platform 2400 may be individually controlled with respect to motion and speed by controlling a motor assembly (not shown) associated with each platform. Hence, at any given time, only those motor assemblies associated with platforms which are transporting substrates along their lengths at any given time need be powered. Additionally, the transport speed of each individual platform 2400 is user-controlled, with transfer speeds generally selectable within a specific range, allowing substrate transport

within sputtering apparatus 10 and return path 50 at varying rates. Each transport platform 2400 is provided with one or more proximity sensors (not shown) which output pallet position signals to the electronic control system of the present invention. This allows the electronic control system and the system operator to identify the location of each and every substrate in sputtering apparatus 10 and along return path 50 at any given time. Three such proximity sensors per transport platform 2400 are provided for each of the 19 platforms used in conjunction with sputtering apparatus 10: 17 platforms in chamber modules 12-30 and two additional platforms at entrance platform 210, at the entrance to load lock chamber 12, and exit platform 220, outside exit lock chamber 30. Twenty (20) transport platforms 2400 are provided along return path 50, each such platform stage along return path 50 having one proximity sensor per platform.

With reference to Figures 13, 14, and 24, each transport platform 2400 includes a motor assembly (not shown) coupled to timing chain assembly 1405, including chains 1410 and 1412, and sprocket wheels 1414-1422, mounted on transport beam 1400. An identical timing chain assembly 1405 is located on the opposite side of each transport platform 2400 (as shown in Figure 14).

Generally, sprocket wheels 1421 and 1422 have a single set of teeth and are mounted to beam 1400 to provide tension adjustment for timing chains 1410 and 1412, respectively. Wheel 1416 has a double set of teeth, one set engaging timing chain 1410 and one set engaging timing chain 1412. Timing chains 1410 and 1412 may be manufactured from polyurethane; however, in load lock chamber 12 and exit lock chamber 30, stainless steel timing chains are required due to reduce excessive

particulate matter generated and circulated during repetitive pump-down and venting cycles when using polyurethane timing chains. Alternatively, stainless steel chains may be utilized throughout the system.

Sprocket wheels 1414 and 1418 may have single or double sets of teeth, as needed. Wheels 1414, 1416 and 1418 are coupled to spindles 1430, passing through beam 1400, which are in turn coupled to rubber roller wheels 1435 in cavity 1440 of beam 1400. Sprocket wheel 1420-1 is coupled to a spindle 1424 passing through beam 1400 into cavity 1440 to translate the motion of sprocket wheel 1420-1 to sprocket wheels 1420-2 located on the opposite side of transport platform 2400. Wheels 1420 generally have two sets of teeth, one set engaging timing chain 1412, the other set engaging a chain or gear assembly coupled to the motor assembly associated with the particular transport platform for powering timing chain assemblies 1405. Through bores 1425 are provided in beam 1400 adjacent to the upper portion of each transport beam 1400 to allow sprocket wheels 1420 to be positioned at any of three points along transport platform 2400 as the positioning of the motor assembly relative to transport platform 2400 requires.

It should be noted that the distance between wheels 1414 and 1416, and the distance between wheels 1416 and 1418, is equal. Further, when assembled into a complete transport system encompassing, for example, both apparatus 10 and return path 50, the distance between respective end wheels 1414 and 1418 on adjacent platforms is equal to the distance from wheels 1414 and 1418 to wheels 1416. Thus, the inter-roller spacing of rubber wheels 1435 is equal through the entire transport system.

Substrate carrier 1450 is receivable in interior cavity 1440 of transport beam 1400. Substrate carrier 1450 includes E-beam assembly 1452 and substrate mounting member 1454. E-beam assembly 1452 enters cavity 1440 seated atop rubber wheels 1435 and is transported along the path of each platform 2400 when the individual motor assembly for that platform drives gears 1420 into motion. Guide wheels 1445 are provided to ensure alignment of substrate carrier 1450, and especially E-beam assembly 1452, within cavity 1440.

Each transport platform 2400 is mounted to a wall portion 1402 of sputtering apparatus 10 by a cross beam 1404 and hex nuts 1406. Dual insulating members 1460 isolate substrate carrier 1450, and individual transport platforms 2400, from thermal and electrical energy which is transferred to pallet 800 during transport through sputtering apparatus 10. Insulating members 1460 may be manufactured from an insulating material such as DuPont's DELRIN thermoplastic elastomer. Insulating members 1460 are preferably bolted to substrate mounting member 1454 and include a T-shaped mounting pin 1470 for securing pallet 800. Apertures 805 are provided on extensions 807 of pallet 800 to allow pins 1470 to pass therethrough and pallet 800 to be mounted on carrier 1450.

Maintaining a contaminant-free environment within sputtering apparatus 10 is crucial to quality control in the provision of multi-layer coatings on substrates. Utilization of an overhead drive transport system in the system of the present invention allows a large variety of substrates to be coated within a single apparatus. However, such overhead systems suffer from excessive particulate generation which may fall from the transport system to contaminate disk substrates carried below.

The transport system of the present invention is provided with unique shielding to prevent particulate contaminants generated by the overhead transport drive system from entering chamber modules 12-30 of sputtering apparatus 10. As shown specifically in Figure 14, contaminant shields 1480 are bolted on the lower portion of transport platform 2400 in the interior of chamber modules 12-30. Shields 1480 are shaped so as to bar particulate contaminants generated by each transport platform 2400 from the interior of chamber modules 12-30. In addition, E-beam assembly 1452 is specifically designed such that ends 1482 of shields 1480 are interposed in grooves 1453 of E-beam assembly 1452, minimizing entry of particulate matter into the interior of chambers 12-30.

The transport system described herein further minimizes particulate generation by eliminating metal-to-metal contact. This particular feature of the transport system provides excellent electrical isolation of the substrate, thus providing the added advantage of allowing the substrate to be biased during, for example, carbon sputtering in chamber 28, thereby improving the quality of the carbon coating deposited.

Each individual transport platform 2400 can move substrate carrier 1450 at a velocity ranging up to 24 ft/min along the entire transport path. Optimally, transport speeds within chambers 12-30 of sputtering apparatus 10 are adjustable up to 24 ft/min. Adjustment of drive speeds and each transfer platform 2400 is controlled by the electronic control system as discussed in Section K of this specification.

H. Substrate Heating System

Uniform substrate temperature is crucial to producing a superior thin film by sputtering processes. Figures 15 through 21 illustrate a heating assembly configuration which accomplishes this goal in sputtering apparatus 10.

Specifically, sputtering apparatus 10 includes a heating assembly whose elements are distributed between dwell heating chamber 14, passby heating chamber 16 and dwell chambers 18 and 22.

As shown in Figures 15 through 17, dwell heating chamber 14 features eight horizontal banks 1510A, 1510B, 1510C, 1510D, 1620A, 1620B, 1620C, 1620D of tubular quartz radiant heating lamps 1514. Banks 1510A, 1510B, 1620A and 1620B are housed in one shallow gold-plated stainless steel tray 1512 and banks 1510C, 1510D, 1620C and 1620D are housed in a second shallow gold-plated stainless steel tray 1512. Each bank 1510A, 1510B, 1510C, 1510D includes eleven 1.5 kW lamps 1514 connected in parallel, vertically aligned and interdigitated to overlap lamp ends between the banks. Individual lamps are separated horizontally by a distance of 3 inches. Each bank 1620A, 1620B, 1620C and 1620D includes three 1.5 kW lamps 1514 connected in parallel, horizontally aligned and interdigitated to overlap lamp ends within each bank. Tubular quartz radiant heating lamps such as those commercially available from General Electric Corporation Lamp Division of Albany, New York are suitable for this purpose.

Within each tray 1512, banks 1510A, 1510B, 1620A and 1620B, and banks 1510C, 1510D, 1620C and 1620D are arrayed vertically. Trays 1512 measure 37.5 in. long (l) by 2-5/8 in. deep (d) by 32-3/8 in. wide (w), with one tray 1512 mounted on chamber door 114, and the other

mounted on rear chamber wall 99. Each tray 1512 is protected from overheating by a circulating coolant fluid provided through cooling lines 1516.

As shown in Figures 18 through 20, passby heating chamber 16 includes ten horizontal banks 1818A, 1818B, 1818C, 1818D, 1818E, 1818F, 1920A, 1920B, 1920C, and 1920D of tubular quartz radiant heating lamps 1514. Each bank 1818A, 1818B, 1818C, 1818D, 1818E, and 1818F features six 1.5 kW lamps 1514 of the same type and mounted in the same fashion as those in dwell heating chamber 14. Individual lamps 1514 are separated by a distance of 2 inches. Each bank 1920A and 1920B features a single horizontally aligned 1.5 kW lamp 1514.

Banks 1818A, 1818B, 1818C, 1920A and 1920B, are arrayed vertically in gold-plated stainless steel tray 1812 and banks 1818D, 1818E, 1818F, 1920C and 1920D are arrayed vertically in a second gold-plated stainless steel tray 1812. With the exception of housing five horizontal banks each, instead of four, trays 1812 are identical in measurement and respective mounting to chamber door 116 and rear chamber wall 100 as trays 1512 in dwell heating chamber 14. Likewise, trays 1812 feature cooling lines 1716 to provide protection from overheating.

The output from banks 1510A, 1510B, 1510C, 1510D, 1620A, 1620B, 1620C, 1620D, 1818A, 1818B, 1818C, 1818D, 1818E, 1818F, 1920A and 1920B, may be set and monitored for individual lamp operating voltages and currents via the electronic controlling system, described fully in Section K, to operate at desired power levels and for desired periods of time. In the present embodiment, heater banks 1510A-1510D, 1620A-1620B, 1818A-1818F, and 1920A-1920D are operated in sets, wherein each set comprises banks 1510A/1510B, 1510C/1510D, 1620A/1620C,

and 1620B/1620D, operated in parallel. Alternatively, bank sets 1620A/1620C, 1620B/1620D, 1510A/1510C, and 1510B/1510D, may be operated in parallel. Similarly, opposing banks 1818A/1818D, 1818B/1818E, 1818C/1818F, and 1920A/1920D are adjustably controlled in parallel. Preferably, independent control of each bank 1510A-1510D, 1620A-1620B, 1818A-1818F, and 1920A-1920B, may be provided by the electronic control system. Such control of banks 1510A, 1510B, 1510C, 1510D, 1620A, 1620B, 1620C, 1620D, 1818A, 1818B, 1818C, 1818D, 1818E, 1818F, 1920A, 1920B, 1920C, and 1920D facilitates adjustment of heating power to meet the preheating requirements of different substrate materials.

As shown in Figure 21, dwell chambers 18 and 22A and 22B each have two gold-plated stainless steel reflecting panels 2120, one each on opposite chamber walls 118, 122A, and 122B and rear chamber walls 101, 102 and 104. Reflecting panels 2120 measure 34-3/8 in. in length by 28 in. in width by 0.09 in. thick.

The heating assembly cooperates with the other elements of sputtering apparatus 10 to contribute to the overall high throughput and high quality sputtered films produced. Specifically, as pallet 800 proceeds through dwell heating chamber 14, banks 1510A, 1510B, 1510C, 1510D, 1620A, 1620B, 1620C and 1620D rapidly commence heating to warm both sides of disk substrates 510 before film deposition. If, for example, the desired substrate temperature is about 200°C, the heating time in dwell heating chamber 14 is approximately 30 seconds. Heating lamp warmup time is negligible since low power (about 143 W) is delivered continuously to the lamps to keep lamp filaments warm.

In the geometrically uniform array of heating lamps created by banks 1510A, 1510B, 1510C and 1510D, more

heat is radiated towards disk substrates 510 carried in the center of pallet 800 as compared to disk substrates 510 carried in rows 810, 820, 870 and 880. In combination with efficient heat reflection from gold-plated stainless steel trays 1512, there is a need to equalize across pallet 800 the amount of heat radiated to individual disk substrates 510. Banks 1620A and 1620B serve as 'trim heaters' to boost the amount of heat radiated to disk substrates 510 carried in rows 810, 820, 870 and 880 of pallet 800. Although such trim heaters are not required, through equalization of heat distribution across pallet 800, trim heaters 1620A and 1620B allow control of coercivity of the deposited film to within about 60 Oe.

To further insure uniform substrate temperature prior to film deposition, a second heating cycle is performed in passby heating chamber 16. Pallet 800 enters passby heating chamber 16 through door D3. The electronic control system enables high power input to banks 1818, 1920, for example, through internal software timers or by reading the output of optical sensor SEN10 (shown generally in Figure 12) capable of detecting pallet motion through the sputtering apparatus 10. As pallet 800 begins to depart passby heating chamber 16, the electronic control system reduces the power of those lamps 1514 positioned at the leading edge of pallet 800 or turns off power to those lamps entirely in response to timing parameters incorporated in the electronic control system software, or sensor SEN13, in order to avoid relative overheating of the trailing edge of the pallet 800.

Banks 1818A, 1818B, 1818C, 1818D, 1818E, 1818F, 1920A and 1920B are initiated and will deliver heat for a preset, empirically determined time as monitored by a

software timer in the electronic control system. In addition, a software delay timer is triggered to control the opening of door D3, allowing pallet 800 to proceed into passby heating chamber 16. As a result, when pallet 800 triggers SEN13 in dwell chamber 18, after a certain period, lamps 1514 on the leading edge of pallet 800 are reduced in power or turned off entirely, depending on the transport speed through dwell chamber 18. In addition, a Mikron temperature sensor (not shown) may be positioned at the entrance of passby heating chamber 16, allowing the system operator through the electronic control system to adjust the power output of banks 1818A, 1818B, 1818C, 1818D, 1818E, 1818F, 1920A, 1920B, 1920C and 1920D to compensate for thermal variations between disk substrates 510 and across pallet 800. In this manner, a uniform temperature profile is established across the surface of pallet 800 and between individual disk substrates 510, thereby avoiding higher coercivities for those substrates positioned on the trailing edge of pallet 800.

Radiative heat losses from pallets and substrates proceeding through sputtering apparatus 10 are minimized by virtue of gold-plated stainless steel reflective panels 2120.

The cooperation of these elements in the heating assembly contributes to the high throughput of sputtering apparatus 10 by promoting rapid and uniform heating of substrates before film deposition. The heating assembly also efficiently maintains the desired substrate temperature by minimizing radiative heat losses as disk substrates 510 proceed through sputtering apparatus 10. Moreover, integration with the electronic control system introduces added flexibility with respect

to selecting and adjusting dwell times and heating rates as required by different substrates and sputtered films.

I. Sputtering Chambers in General

As shown in Figures 1 and 2, the present invention includes three in-line sputtering chambers 20, 26, and 28 to deposit a multilayer film, including chromium, CoCrTa and carbon thin films, respectively. Those skilled in the art will recognize that the application of the following principles to design a sputtering apparatus with greater or fewer sputtering chambers or with the capability to deposit more or fewer films is within the contemplation of the present invention. Moreover, all of the sputtering chambers within a particular sputtering apparatus need not be devoted to sputtering films. Indeed, any given sputtering chamber may participate in the overall process solely to the extent of serving as a pressurized inert passageway for substrates.

The following description relates to the internal configuration of each sputtering chamber, which is symmetrical about the line of pallet travel through the sputtering apparatus 10. Figures 13, 14 and 23 through 28 illustrate various aspects of the sputtering chambers and will be referred to as necessary.

Referring to Figures 13, 14, 22 and 23, sputtering chamber 20 generally represents the internal configuration of sputtering chambers 20, 26 and 28. By way of explanation, only chromium sputtering chamber 20 will be hereafter described. Only one-half of the chamber is described with the understanding that the description applies to both halves.

Four planar (rectangular) cathodes 2222, 2223, 2224 and 2225 are mounted through insulative layer 121 to

door 120. Door 120 is rotatable about hinge 1326 to allow access to the interior of chromium sputtering chamber 20, for example, for maintenance purposes. Interlocked protective cover 2305 interrupts the power supply to chromium sputtering chamber 20 when door 120 is opened.

Cathodes 2222-2225 may be composed of a material such as copper and measure about 36 inches in length by 5-1/2 inches in width by 1.125 inches thick. Cathodes 2222-2225 are provided with cooling lines 2552 to protect against overheating. Cooling lines 2552 supply a cooling fluid such as water along cooling conduits 2554 in cathode surface 2550.

As illustrated in Figures 14, 22 and 23, targets 2226-2229 are mounted one per cathode 2222-2225, with the target being nearest the line of pallet travel through chromium sputtering chamber 20. Within any given sputtering chamber, the composition of all four targets depends upon the film to be deposited, but may be chromium, a magnetic alloy or carbon. Likewise, the thickness of the targets depends upon the type and the thickness of the film to be deposited. In the case of the chromium and magnetic sputtering chambers 20 and 26, the target-to-substrate distance 'a' is about 2-3/4 inches and the target-to-substrate distance 'a' for carbon targets is 2-11/16 inches because the chromium and magnetic targets are thicker than the carbon target.

Referring now to Figures 21 through 24, shields 2230, 2236, 2238 and 2240 are mounted one per cathode 2222-2225. Shields 2230, 2236, 2238 and 2240 may be composed of a material such as copper and are generally rectangular in shape with peripheral flanges 2232 and 2234. Shield extension 2231 extends from shield 2230 into the chamber interior. Shields 2230, 2236, 2238 and

2240 are cooled by cooling lines 2336. A combined anode and dark space shield 2338 is incorporated into each shield 2230, 2236, 2238 and 2240.

The sputtering process occurs with the targets sputtering in a sideways fashion, depositing the desired film on each side of disk substrates 510 as pallet 800 proceeds through each sputtering chamber. As Figures 27A and 27B show, during sputtering, flux (represented by vectors $\bar{A}$ and $\bar{B}$) leaves the target surface diffusely, depositing on the disk substrates and other surfaces within the sputtering chamber. As discussed previously, in-line sputtering of disk substrates can introduce undesirable magnetic anisotropies into the deposited film. Shields 2230, 2236, 2238 and 2240 intercept the obliquely incident flux (vector $\bar{A}$) from targets 2226-2229 such that only flux substantially normal to the surface of target 2228 (vector $\bar{B}$) is deposited on disk substrates 510. Specifically, peripheral flanges 2232 and 2234, extending the length of each shield, project toward the line of pallet travel through any given sputtering chamber. Shield 2230 also features shield extension 2231 which similarly projects toward the line of pallet travel. Peripheral flanges 2232 and 2234 and shield extension 2231 block deposition from high- and low-angle flux (vector $\bar{A}$) as disk substrates 510 enter and exit each sputtering chamber, while providing an unhindered path for normal flux (vector $\bar{B}$) to the substrates.

Figures 25 and 26 illustrate the configuration of cathode 2222 in more detail. Cooling lines 2552 discharge cooling fluid along surface 2550 in shallow channels 2554 and an O-ring (not shown) disposed in channel 2556 prevents coolant leakage outside of channels 2554. On the reverse side of cathode 2222,

surface 2658 is adapted to receive screws in holes 2660 for mounting cathodes 2222-2225 onto chamber doors 120-1 and 120-2. Surface 2658 is configured to support and receive a magnet and magnetic pole piece assembly to produce the desired magnetic field. The assembly is created in a network of channels in surface 2658 consisting of center channel 2662, intermediate circumferential channel 2664 and outer circumferential channel 2666. Channels 2664 and 2666 are configured as concentric closed loops or ovals surrounding center channel 2662.

Typically, target utilization in sputtering operations are about 15-20% for nonmagnetic materials and about 30-35% for magnetic materials. Considering the high costs associated with the purchase and replacement of target materials, optimal target utilization is another prime concern in sputtering operations. Magnet and magnetic pole piece assemblies used in the present invention substantially improve target utilization, enhancing both production throughputs and cost-effectiveness.

Figures 27A and 27B illustrate in greater detail the magnet and magnetic pole piece assemblies for nonmagnetic (e.g., chromium and carbon) and magnetic (e.g., CoCrTa) targets, respectively. Each magnet 2768 is 1-inch long by 5/16-inch wide by 3/16-inch thick and magnets 2769 are 1-inch-long by 5/16-inch wide by 3/8-inch thick, with north and south pole directions indicated by arrows pointing up and down, respectively. Ferritic magnets of neodymium, iron and boron (NeFeB or "Neo iron") are preferred in the present invention.

Along with magnets 2768 and 2769, magnetic pole pieces 2770 and 2774 are arrayed in channels 2662, 2664 and 2666. Magnetic pole pieces 2770 may be adapted to

receive screws therethrough for securing the magnet and pole piece assembly within the channels as necessary. A nonmagnetic material 2772, such as aluminum in block or continuous form, is positioned so as to fill the channels as necessary and preclude shunting of the magnetic flux between adjacent magnetic pole pieces 2770. Iron plate 2274 serves as a backing plate for the magnetic and pole piece assembly.

For a nonmagnetic target layout, center channel 2662 of each cathode contains about 25 magnets 2769 separated by 1/4-inch spaces and 25-inch pole piece strips 2770 above and below magnets 2768. Intermediate circumferential channel 2662 contains about 35 magnets 2768 separated by 1-inch spaces, two 31-inch pole piece strips 2770, two 31-inch pole piece strips 2774 adjacent to aluminum filler 2772 with additional pole pieces 2770 for fitting the cropped corners of intermediate channel 2664. Outer circumferential 2666 contains about 33 magnets 2769 and two 33-inch pole piece strips 2770 with additional pole pieces 2770 for fitting the cropped corners of outer circumferential channel 2666. The overall effect of the magnet and the pole piece assembly for the nonmagnetic target shown in Figure 27A is to produce a magnetic field strength above the target surface of 400 Gauss at the center of the erosion region.

For a magnetic target layout, center channel 2662 contains about 25 magnets 2769 with one overlying 25-inch pole piece 2770. Intermediate circumferential channel 2664 contains about 35 magnets 2768 overlaid with two 31-inch pole pieces 2770 and additional pole pieces 2770 for fitting the cropped corners of intermediate channel 2664. Aluminum filler material 2772, in block or continuous form, occupies remaining

vacancies in intermediate channel 2664. The overall effect of the magnet and pole piece assembly for a magnetic target shown in Figure 27B is to produce a magnetic field strength of about 400 Gauss at the center of the erosion region.

As noted above, the purpose of the magnetic field is to trap electrons and ionized species in the plasma and enhance the sputtering rate induced by the circulating plasma above the target surface. The magnetic field 2700 generated by the magnet and magnetic pole piece assemblies used in the present invention approximate an ideal magnetic field 2700 where the vertical components of the magnetic fields above the nonmagnetic (Figure 27A) and magnetic (Figure 27B) targets are reduced. As a result, greater target utilization is obtained since the magnetic fields and plasma are focused across a relatively greater portion of the target surface.

Target utilization may be further improved by increasing the magnet loading density within the channel network. For example, by loading intermediate channel 2664 with 24 magnets 2768 separated by 1/2-inch spaces, nonmagnetic target utilization increases to between 50% and 65%. For magnetic targets, an increased utilization of between 35% to 50% may result.

Figure 28 illustrates the film structure which may be produced by the present invention on nickel-phosphorus plated aluminum disk substrate 510. A 800Å to 2000Å (1000Å preferably) chromium underlayer 2800 is deposited first on disk substrate 510. A 500Å to 850Å CoCrTa magnetic layer 2802 may be deposited over the chromium underlayer. As a result of the circumferential texturing of the disk surface as discussed previously in Section C.2, the 'C' axis of the hcp structure of the magnetic cobalt alloy is aligned in the film plane.

Finally, a 350Å carbon overlayer 2804 may be deposited, incorporating some hydrogen, as discussed in Section J.

J. <u>Carbon Sputtering</u>

Sputtering chamber design in sputtering apparatus 10 for carbon films requires additional refinements to optimize wear and corrosion resistance properties. These refinements are discussed herein with reference to Figure 13, as necessary.

Experiments have shown that the incorporation of hydrogen into sputtered carbon films improves wear-resistance properties. In sputtering apparatus 10, hydrogen incorporation is achieved by sputtering in an argon atmosphere containing up to about 15% of a hydrocarbon gas. In particular, carbon films sputtered in the presence of ethylene/argon or acetylene/argon showed a 300% improvement in wear resistance as compared to carbon films sputtered in pure argon atmospheres. Thus, as compared to chromium and magnetic sputtering chambers 20 and 26, carbon sputtering chamber 28 uses a gas line for argon/hydrocarbon gas mixture to supply hydrocarbon gas flow during sputtering.

A second type of chamber refinement in the carbon sputtering chamber relates to the need for substrate bias. As noted above, during sputtering, primary or "fast" electrons dislodge from the target and join the plasma. These fast electrons are constrained to field lines in the plasma where they may ionize argon atoms or may be attracted to positively biased regions within the sputtering chamber. Deposition of dielectric target materials, such as carbon, on surfaces other than the substrate can reduce the electrical conductivity of those surfaces and inhibit the electron grounding thereon. As a result of the reduced electrical

conductivity, fast electrons either scatter and ionize argon, or are therefor available to impinge on the substrate, whether positively biased or grounded. In the event of the latter, the substrate may be heated sufficiently by electron bombardment to cause graphitization of the growing carbon film.

One means of avoiding graphitization resulting from electron bombardment of the substrate is to apply a negative bias to the substrate to repel any stray electrons. As shown in Figure 13, arcuate phosphorus-bronze fingers 1302 depending from insulating block 1304 and connected to an external voltage source (not shown) provide an electrical contact to pallet 800 by which a negative bias may be applied. More specifically, as pallet 800 proceeds through carbon sputtering chamber 28, phosphorus-bronze fingers 1302 brush against the bottom edge of pallet 800 and establish the desired negative bias. At least one phosphorus-bronze finger 1302 maintains contact with the moving pallet while pallet 800 is in carbon sputtering chamber 28.

A third refinement relates to a reduction of pallet transport speed through carbon sputtering chamber 28. As a target surface is increasingly eroded during sputtering, the once-flat surface eventually develops a depression which mirrors the magnetic field lines. As a result, the magnetic field lines emerging from the target are no longer perpendicular to the electric field lines at the target surface. The significance of the growing erosion region is that during sputtering, target species continue to leave the erosion region in a path perpendicular to the surface, i.e., according to a cosine distribution, even where the eroded target surface is no longer uniformly flat. Therefore, an increasing portion of the flux leaving the target

surface is intercepted by shields 2230 as otherwise obliquely incident flux. In other words, a correspondingly decreasing portion of the flux is deposited on disk substrates 510 (and pallet 800) as the desired normally incident flux, thereby decreasing the overall film deposition rate. In general, such a decrease in deposition rate may be compensated for directly by increasing the power supplied to the cathodes. For carbon targets, it has been discovered that this method of compensation is impracticable because increased power input to and resultant heat from the cathodes would induce undesirable graphitization.

The carbon target is also altered by redeposition of carbon from the flux into the erosion region. Specifically, since carbon is a dielectric material, such redeposition reduces the electrical conductivity of the target, further decreasing the carbon sputtering rate and may cause arcing. For conductive target materials like metals, redeposition is not similarly problematic.

Accumulations of the redeposited carbon, which appear as large blemishes or warts, may be removed by grinding the carbon surface. However, such a solution to the redeposited carbon problem is time- and labor-intensive, and consequently is not preferred because it detracts from the high throughput capability of the sputtering operation of the present invention. A much more manageable and attractive solution directly minimizes graphitization by holding deposition power to the cathodes constant and reducing the pallet transport speed from the typical rate of 3 feet/minute, via the electronic control system to, for instance, about 2.8 ft/min, to compensate for the lower deposition rate.

K. Electronic Control System

The electronic control system for sputtering apparatus 10 and the process of the present invention provides one or more system operators with the means to comprehensively and efficiently control production throughput, applied sputtering power, and other sputtering apparatus parameters. The electronic control system is preferably programmable to allow a plurality of different operating parameter settings to be stored for each of the adjustably controlled elements of the sputtering process. Thus, the electronic control system generally performs two major functions: (1) monitoring sputtering apparatus 10 by reading data input from every aspect of sputtering apparatus 10, and providing status data to the system operator(s); and (2) controlling the sputtering process by providing user-controlled and automatically generated control signals to the functional elements of sputtering apparatus 10.

The electronic control system of the present invention will be described with regard to Figs. 12, 29 and 30. Figure 12 is a diagram of the vacuum and chamber pumping system of the present invention, including general representations of the location of the various signals and components controlled, or read by, the digital input/output of programmable logic controller 2902. Figures 32A-B represent a logical flow diagram of the programmable logic software controlling the motor assemblies powering transport platform arranged in chambers 12-30 in apparatus 10 of the present invention.

Referring to Figure 29, the major functional elements of the control system of the present invention are shown. Since both digital and analog input/output must be provided for in one embodiment, two main process

controllers are used: a programmable process logic controller 2902, preferably an Allen Bradley PLC-5 programmable process logic controller, and an IBM-compatible, Intel-type 80386 or 80486 microprocessor based, computer 2901. It should be understood by those skilled in the art after review of the specification that the particular choice of process controllers is not crucial to the invention, as long as the process controller(s) can sufficiently handle input/output (I/O) in both analog and digital form to meet the comprehensive requirements of the control system described herein.

The Allen Bradley PLC-5 is manufactured by Allen Bradley Company, Milwaukee, Wisconsin, and includes at least one PLC-5 processor module and a number of input/output modules attached thereto. The input/output modules provide an expandable number of inputs and outputs to handle any number of digital I/O signals.

Programmable logic controller 2902 monitors digital input and provides digital output to those elements of the sputtering apparatus which require two-state control signals. These elements are described in detail below. Allen Bradley PLC-5 uses logic control software configured as "ladder" logic table diagram, a copy of which is included in Section M, to control input and output. In general, this software allows programming of the sensory input and output in a Boolean-type fashion along a series of horizontal timing "rungs". The entire "ladder" is scanned, top to bottom, every .030-.040 second, and each addressed element of I/O is examined by the processor. Each rung is programmed with both internal and external I/O, and generates an output command -- either internal or external -- if each element in the horizontal rung is "true". In this

manner, it will be recognized that horizontally linked elements are ANDed together, while vertically linked elements are ORed. Each rung may be cross-referenced and nested to other individual rungs to achieve the desired logical output. The output of each rung may comprise an "enable," "latch" or "unlatch" signal, depending on the nature of the timing utilized in the particular program.

Computer 2901 primarily controls analog input/output to the various elements of sputtering apparatus 10 via a SIXNET network interface 2903, such as that manufactured by Digitronix SIXNET, Inc., Clifton Park, New York, although some digital input/output functions are handled by the computer 2901. The SIXNET network interface 2403 is coupled to computer 2902 via 307,200 baud SIXNET Model 60-232/N-DL network modem (not shown) coupled to a RS-232 serial port on, for example, a peripheral extension card provided in an expansion slot of computer 2901. Such an extension card may comprise, for example, an IBM Real Time Interface Co-Processor (ARTIC) card manufactured by International Business Machines, Boca Raton, Florida.

In order to handle a sufficient quantity of digital and analog I/O, the network interface 2903 comprising a SIXNET I/O network may include eight SIXNET 60 I/O MUX-FEB multiplex stations, each of which may include two RS-232 serial ports or alternative expansion capability, and sixteen dedicated I/O terminals. The multiplex stations are interlinked by the 307K baud SIXNET network interface. Data I/O of each such station may be configured as the constraints of the physical facility and sputtering apparatus 10 require to couple the necessary I/O signals to the network interface 2903. Network interface 2903 may include SIXNET 60-A/D 16-32

analog-to-digital converters, 6-D/A 12B-8 digital-to-analog converters, and 6-IO32 FET digital/analog input/output modules to handle additional digital and analog I/O as required.

Programmable logic controller 2902 and computer 2901 may communicate via a data highway 2911, utilizing an RS-232 serial bus coupled between one RS-232 serial port of the ARTIC peripheral card (discussed above) located in computer 2901, and an Allen Bradley 1171-KF2-B communications interface 2911. Interface 2911 is coupled to programmable logic controller 2902 via serial data highway 2912.

Computer 2901 utilizes a user interface and system control software to monitor, control, generate alarms and store data for apparatus 10. One such software suitable for this purpose is "The Fix", produced by Intellution Corporation, Norwood, Massachusetts. The software allows development of a graphic interface environment for data input/output by creating signal control databases linking the particular interface environment to specific control signals output from, and data sensing signals input to, computer 2901. Thus, input data is transmitted via network interface 2903 from the various components of apparatus 10 to computer 2901 to be provided as direct readout to the user I/O environment created using the interface and control software to provide easily readable data to the system operator and/or to create output flags to programmable logic controller 2902.

A limited number of output signals are provided by The Fix software to programmable logic controller 2902. These signals comprise combinational results of specific input signals and act as triggers for programmable logic controller 2902. This specific programming code utilized

in "The Fix" software to generate these signals is included as Section N.

As with the particular process controllers utilized in the present invention, it will be noted by those skilled in the art that the particular software utilized in the process controllers to provide data input/output is not crucial to the substance of the invention; any suitable process control software may be utilized within the scope of the invention to generate any number of suitable user interfaces.

A second, IBM compatible computer 2907 is coupled to programmable logic controller 2902. Computer 2907 may be utilized as a separate programming computer allowing on-line monitoring, debugging, and programming of the ladder logic software in programmable logic controller 2902 utilizing a debugging software, such as that manufactured by ICOM Incorporated, Milwaukee, Wisconsin.

User interfaces are provided for both programmable logic controller 2902 and computer 2901. User interface 2905 coupled to programmable logic controller 2902 may comprise a NEMATRON touch screen, manufactured by NEMATRON, Inc., Ann Arbor, Michigan, which allows data input/output through a series of custom designed, touch sensing, display screens. When utilizing the NEMATRON touch-screen with the Allen Bradley PLC-5, a BASIC module 2906 is provided in the Allen Bradley and coupled to the NEMATRON. The BASIC module is utilized for selecting the display screens on the NEMATRON and for linking particular screen input/output to the data input/output of the Allen-Bradley PLC-5.

Computer 2901 is coupled to user interface 2904, which preferably comprises a standard high resolution graphics display monitor and keyboard. An EGA or VGA

type high-resolution graphics display, such as the NEC Multisync II, manufactured by NEC Information Systems, Inc., Boxborough, Massachusetts is suitable for use as user interface 2904. Again, it should be understood that any conventional input/output interface may be utilized with the process controllers of the electronic control system while remaining within the scope of the invention.

The electronic control system of the present invention governs three major functions: movement of the substrate through apparatus 10; sputtering process control within apparatus 10; and status indication for apparatus 10. Referring to Figure 29, movement of the pallet 800 and disk substrate 510 through the process is governed by the electronic control system through motor control system 2910, position sensing system 2915, and door control system 2920. Process control and status indication are governed by mechanical pump control system 2925, pump valve and vent control system 2930, cryogenic pump and compressor control system 2935, vacuum valve control system 2940, gas flow control system 2945, gas pressure control system 2950, heater control system 2955, substrate temperature sensing system 2960 sputtering power supply control system 2965, coolant control system 2970, gauge control system 2975 and residual gas analyzers 2980.

With reference to Figure 29, the elements of the electronic control system, and their relationship to programmable logic controller 2902, computer 2901, and network interface 2903 are hereinafter described. It should be understood by those skilled in the art that the elements defined in Figure 29 are arranged in the manner shown for explanation purposes only; various

modifications of the system are contemplated as being within the scope of the invention.

1. Motor Control System 2910

Movement of the substrate through in-line sputtering apparatus 10 is controlled by the substrate transport system, discussed with the reference to Figs. 8-11. As noted therein, each separate transport platform 2400 has a variable speed motor assembly associated therewith and coupled thereto controlling the velocity of the substrate movement at that specific platform in the transport system loop.

With respect to apparatus 10, nineteen (19) individual transport platforms are provided to carry the substrate through the seventeen (17) chambers of sputtering apparatus 10, and load and unload ramps, 210, 212, respectively. Nineteen motors M3-M21 are controlled by three BAM-8 Berkeley Axis Machine (BAM) multi-access servo controllers (not shown). Each BAM-8 can simultaneously control up to eight axis of high performance servo motors, and provide multiple, preset, user-defined motor speeds for each axis, allowing digital input signals to activate preprogrammed control sequences for each axis controlled by each particular BAM-8. Each BAM-8 provides eight separate variable voltage output signals, one per axis, to the motor assemblies to control motor speed and, consequently, the velocity of the target substrate at each particular platform in the transport system. Each BAM-8 is preferably coupled by one RS-232 port from one of the eight SIXNET multiplex stations to each BAM-8.

Two sets of nineteen digital outputs from programmable logic controller 2902 provide motor velocity control signals M3F-M21F, M3S-M21S to the BAM-

8 motor controllers. The two-bit control signal provided by signals M3F-M21F, M3S-M21S allows two individual forward speed settings, start/stop, and, forward/reverse direction to be controlled by programmable logic controller 2902. Nineteen additional digital outputs from programmable logic controller 2902 provide motor interrupt signals M3I-M21I to the BAM motor controllers.

Thirty-eight (38) analog output signals DMOTLO1-DMOTLO21, DMOTHI1-DMOTHI21 are provided for selection of individual motor speed set points of motors M3-M21. The high and low speed setpoints defined by DMOTLO1-DMOTLO21, DMOTHI1-DMOTHI21 define the motor speeds controlled by signals M3F-M21F, M3S-M21S from programmable logic controller 2902; once set, the BAM-8 automatically controls each motor to meet the desired setpoint state. Optimal motor setpoints are listed in Table 1:

TABLE 1

Motor #	Setpoints (ft./minute) Fast	Slow
M3	12.0	7.5
M4	12.0	7.5
M5	12.0	6.0
M6	6.0	6.0
M7	6.0	6.0
M8	6.0	6.0
M9	12.0	6.0
M10	12.0	6.0
M11	12.0	6.2
M12	12.0	6.2
M13	6.0	6.2
M14	6.0	6.0
M15	6.0	2.7
M16	6.0	2.7
M17	12.0	2.7
M18	12.0	6.0
M19	12.0	6.0
M20	12.0	6.0
M21	12.0	6.0

Hence, motor control system 2910 provides multiple velocity movement of a substrate through the sputtering apparatus which is useful for controlling a plurality of substrates moving through the sputtering system simultaneously.

2. Substrate Position Detection System 2915

Substrate position detection system 2915 represents the capability of electronic control system to detect and monitor movement of all substrates entering, exiting, or passing through apparatus 10. Fifty-seven pallet position sensors SEN1-SEN57 may be provided in chamber modules 12-30, and entrance and exit platforms 210, 220 to inform programmable logic controller 2902, (and the system operator) of the exact position of each substrate in apparatus 10. Generally, three sensors per pallet platform are provided. Preferably, optical

position sensors are utilized in chambers 14 and 16 due to their ability to withstand the high temperatures present in those chambers. It should be recognized that it is preferable to provide three sensors per platform for greater accuracy in determining substrate position; in the present embodiment, to improve durability, only two position sensors are utilized in chambers 14 and 16 to reduce sensor failure rates. Each sensor SEN1 - SEN57 provides a digital output signal to programmable logic controller 2902 indicating the presence or absence of a substrate at the sensor's position. Such a comprehensive position detection system provides fault detection in the event a substrate becomes jammed at any point in the sputtering process, permitting the user to compensate for such problems and forestall problems on subsequent substrates in apparatus 10.

Twenty-one additional pallet position sensors (not shown) are provided on the twenty transport platforms utilized in return path 50 (two on the last platform before load station 40). Each such sensor output signal may be provided to programmable logic controller 2902, as shown in Figure 12; alternatively, return path sensor signals may be provided to a separate programmable logic controller.

3. Door Control System 2920

Twelve chamber isolation doors D1-D12 are provided to separate certain individual ones of compartment chamber modules 12-30. Each door D1-D12 is operated by a pair of pneumatic cylinders (not shown), each cylinder having a pair of solenoid triggers responsive to DROP and DRCL signals to each cylinder in a direction to open or close the door, respectively. Movement of each of doors D1-D12 is governed and detected by door control

system 2920. Twenty-four (24) dedicated digital outputs from programmable logic controller 2902 provide pulsed control signals to door open solenoids DROP1-DROP12, and door close solenoids DRCL1-DRCL12.

Additionally, door position sensors are provided to detect each door's opened or closed state for the control system software. Door open sensors DROP1S-DROP12S and door closed sensors DRCL1S-DRCL12S provide direct digital output signals to twenty-four (24) digital inputs of programmable logic controller 2902.

A high pressure air supply (not shown) is used in the sputtering apparatus to provide the requisite air pressure for the pneumatic valves, including door cylinders, high vacuum valves, and other such system components. Primary air sensor APS detects the existence of the high pressure air supply and the absence of a ABS detection signal input to one input of programmable logic controller 2902 initiates a system shutdown override. In addition, eight pressure switches PS1-PS8 are provided to check for the existence of discrete pressure states at various points in the pumping system and apparatus 10. Switches PS1-PS8 redundantly check for a lack of evacuation pressure in pumping conduits in apparatus 10 in the position as shown. Eight digital output signals indicating the detection, or lack thereof, each discrete pressure state are input to programmable logic controller 2902.

4. <u>Mechanical Pump Control System 2925</u>

Three mechanical roughing pumps MP1-MP3 and blowers BL1-BL3 provide initial vacuum pumpdown of sputtering apparatus 10, and explosive pumpdown in load lock 12 and exit lock 30 in accordance with the description of the pumping system discussed in section F of this

specification. Mechanical pumps MP1-MP3 provides high speed pumping up to approximately 20-50 mTorr, while blowers BL1-BL3 provide pumping down to about 1 mTorr before the cryo pumps engage. Mechanical pumps MP1-MP3 and blowers BL1-BL3 thus act in concert to provide rapid pumping of apparatus 10.

On/off controls for mechanical pumps MP1, MP2, and MP3, and blowers BL1, BL2, and BL3, are provided by six digital output signals from programmable logic controller 2902.

5. <u>Mechanical Pump Valve and Vent Control System 2930</u>

Five roughing valves RV1-RV5 isolate mechanical roughing pumps MP1-MP3 and blowers BL1 - BL3 from chambers 12-30 of sputtering apparatus 10. In addition, five chamber vent valves CV1-CV5 allow for venting chambers 12, 18, 22B, 22D, and 30 between the evacuated, sputtering atmosphere and the ambient environment outside apparatus 10.

Mechanical pump valve and vent control 2930 controls roughing valves RV1-RV5, monitored by roughing valve sensors RVS1-RVS10, and chamber vent valves CV1-CV5, monitored by chamber vent sensors CVS3-8. In the absence of sensors associated with any valves, the on/off condition of any valve can be determined by referencing the software output commands (for example, for valves CV1 and CV5).

Thirteen outputs of programmable logic controller 2902 are provided to mechanical pump valve and vent control 2930. A first set of five outputs controls the open/close state of roughing valves RV1-RV5, a second set of five outputs controls the open/close state of chamber vent valves CV1-CV5, and a third set of three

outputs controls the open/close state of pump vent valves PV1-PV3. In addition, twenty dedicated digital inputs of programmable logic controller 2902 are provided for signals received from roughing valve sensors RVS1-RVS10 and chamber vent valves sensors CVS3-CVS8. Roughing valve sensors RVS1-RVS10 and chamber vent valve sensors CVS3-CVS8 provide state signals to programmable logic controller 2902 to indicate the state of each respective valve CV2-CV4 monitored, thereby allowing the user and the system to more accurately monitor pumpdown and venting of the system. Additional chamber vent valve sensors may be provided on chamber vent valves CV1 and CV5, however because of the high usage of these values, sensor failure occurs rapidly.

6. <u>Compressor and Cryogenic Pump Regeneration Control System 2935</u>

The electronic control system includes a cryogenic pump regeneration and compressor control 2935 which controls the start/stop function of compressors CY1-CY12, nitrogen supply N2, and nitrogen heaters NIH1-NIH12. In addition, cryogenic pump and compressor control 2935 provides on/off control to sieve heaters SVHTR1-SVHTR12 and sieve valves SVIV1-SVIV12, used in flushing contaminants from cryogenic pumps C1-C12 during the cryogenic pump regeneration process discussed above. Nitrogen supply N2 and heaters NIH1 - NIH12 are also used to flush and clean cryogenic pumps C1-C12.

As discussed above in section F of this specification, cryogenic pumps C1 - C12 are provided to create an evacuated environment in chambers 12-30 in accordance with the sputtering process of the present invention. Compressors CY1-CY8 (Figs. 3 and 12) provide helium gas to cryogenic pumps C1 - C12 to enable

cryogenic pumps C1 - C12 to create the necessary vacuum in sputtering apparatus.

Eight outputs of programmable logic controller 2902 control the start/stop state of compressors CY1-CY8.

Eight nitrogen flow sensors NIFS1-NIFS8 detect and insure the presence of nitrogen to nitrogen flow heaters NIH1 - NIH12. Eight programmable logic controller 2902 digital inputs receive flow detection signals from sensors NIFS1-NIFS8. Twelve digital outputs of programmable logic controller 2902 control the start/stop functions for nitrogen heaters NIH1-NIH12. An additional twelve digital outputs of programmable logic controller 2902 provide open/close state control over nitrogen flow valves NIF1-NIF12.

Also included in cryo regeneration and compressor control 2935 are sensors, not shown, coupled with cryo pumps C1 - C12 to monitor the temperature of cryo pumps C1 - C12 during the cryo regeneration process and during the sputtering process. Twelve analog network interface 2403 inputs receive the analog temperature signals TD1-TD12, over a range of 3°K - 350°K.

Cryo roughing valves CR1-CR12 are provided to control outgassing of cryogenic pumps C1-C12 through sieve heaters SVHTR1-SVHTR12. As noted above, cryo roughing valves CR1-CR12 function in concert with sieve heaters SVHTR1-SVHTR12 in removing contaminants from cryo pumps C1-C12 during the cryo regeneration process. The open/close states of cryo roughing valves CR1-CR12 are controlled by twelve digital outputs of programmable logic controller 2902.

Control of sieve heaters SVHTR1-SVHTR12 and sieve valves SVIV1-SVIV12 is provided by 24 digital outputs of programmable logic controller 2902: twelve (12) digital outputs of programmable logic controller 2902 control

the start/stop functions of sieve-heaters SVHTR1-SVHTR12; twelve outputs of programmable logic controller 2902 control sieve-isolation valves SVIV1-SVIV12.

7. Vacuum Valve Control 2940

Vacuum valve control 2940 provides on/off switching control for, and receives feedback from, high vacuum valves HV1-HV12 coupled between cryogenic pumps C1 - C12, and sputtering apparatus 10. Feedback for high vacuum valves HV1-HV12 is provided by 32 high vacuum sensors HV1S1, HV1S3, HV2S1, HV2S2, HV2S3, ... HV12S1, HV12S2, HV12S3.

High vacuum valves HV2-HV11 are three state (OPEN, CLOSED, and THROTTLE) operation valves. The THROTTLE state is used during operation of the sputtering system to maintain the vacuum level sputtering apparatus, subsequent to initial pumpdown, as the needs of each particular chamber require. High vacuum valve HV1 operates as a two-state (open/closed) valve, and is utilized with baffle 1210. Twenty-four (24) digital outputs (HV1_1, HV1_2, HV2_1, HV2_2, ... , HV12_2) are dedicated by programmable logic controller 2902 to provide twelve, two-bit control signals for high vacuum valves HV1-HV12 and baffles 1210, 1214, to select one of the three states of valve operation discussed above for valves HV2-HV12, or two states for valve HV1, and enable/disable baffles 1210, 1214. Thirty-five (35) digital inputs of programmable logic controller 2902 monitor high vacuum sensors HV1S1 -HV12S3 for respective valves HV1-HV12. One sensor is provided for each operational state of each high vacuum value as applicable.

8. Gas Flow Control 2945

Gas flow control system 2945 controls the sputtering gas supply for apparatus 10.

Flow control for the primary and secondary gasses, discussed above, may be accomplished through use of eight MKS Instruments, Inc., (Andover, Massachusetts) model 2259B mass flow meters and flow controllers, including MKS model 246 readout displays. Eight isolation valves GF1-GF8 are located between each 2259B mass flow meter and its associated model 246 display. Eight flow control valves FLO1-FLO8 control the flow rate of the primary and secondary gases.

Eight digital outputs of programmable logic controller 2902 are dedicated to control the open/close state of isolation valves GF1-GF8. Computer 2901 receives eight analog input (0-5 volt) flow measurement signals (designated FLO1-FLO8 by "THE FIX") to monitor gas flow via the model 2259B mass flow meters. Flow setpoints of flow controller valves FLO1-FLO8 of the model 2259B mass flow meters are controlled by eight 0-5 volt output signals FLOST1-FLOST8 through network interface 2903 under the control of computer 2901.

9. <u>Gas Pressure Control System 2950</u>

In conjunction with gas flow control system 2945, discussed above, gas pressure control system 2950 monitors and controls pressure in apparatus 10 through a series of four capacitance manometers CM1-CM4, each capacitance manometer CM1-CM4 being separated from apparatus 10 by an associated isolation valve CHV1-CHV4. Each capacitance manometer CM1-CM4 and isolation valve CHV1-CHV4 may comprise, for example, MKS model 390H and 270B capacitance manometers manufactured by MKS Instruments, Inc., supra. MKS model 390H and 270B capacitance manometers include outputs providing analog

output signals to computer 2901 for monitoring the gas pressure measured thereby, and digital signal inputs to allow for variable control of the metering range of each capacitance manometer or CM1-CM4. Generally, capacitance manometers CM1-CM4 monitor pressure in apparatus 10 subsequent to evacuation of chambers 14-29 by mechanical pumps MP1-MP3. Specifically, gas pressure monitoring during pump-down of apparatus 10 is provided by twenty pirani gauges PIR1 - PIR20; at crossover, the point at which evacuation by mechanical pumps MP1-MP3 blower BL1-BL3 ceases and pumping by cryogenic pumps C1-C12 begins, capacitance manometers CM1-CM4 are used.

Four outputs of programmable logic controller 2902 are dedicated to control open/close states of isolation valves CMV1-CMV4. Four inputs of network interface 2903 receive analog pressure readouts (designated CM1-CM4 by "THE FIX") of capacitance manometers CM1-CM4. Eight discrete outputs of network interface 2903 are dedicated to provide 2-bit digital signals CMR1.1, CMR2.1, CMR1.2, CMR2.2, CMR1.3, CMR2.3, CMR1.4, CMR2.4 to control the pressure metering range of capacitance manometers CM1-CM4.

10. <u>Heater Control System 2955</u>

Substrate heating, including dwell heating in chamber 14 and passby heating in chamber 16, to maintain a uniform temperature gradient over the substrate surface is governed by heater control system 2955. Control of both the "dwell" and "passby" heater banks 1510A, 1510B, 1510C, 1510D, 1620A, 1620B, 1620C, 1620D, 1818A, 1818B, 1818C, 1920A, 1920B, 1920C, 1920D, discussed in Section H of this specification, may be provided by eight Emerson Spectrum III Heater

Controllers, manufactured by Emerson Industrial Controls, Grand Island, New York. The Emerson Spectrum III controllers allow digital heater temperature setpoint control of the quartz lamp heating elements discussed in section H. Thus, heater setpoints once set will be maintained by each Spectrum III.

In the present embodiment, heater control system 2955 thus utilizes: eight digital outputs of programmable logic controller 2902 providing on/off control signals RH1A-RH3C to the Emerson Spectrum III controllers; eight digital outputs of programmable logic controller 2902 controlling high/low output enable RH1A-RH3C for the Emerson Spectrum III controllers; eight inputs of programmable logic controller 2902 receiving heater fault signals H1A0FLT-H3C0FLT; eight analog outputs from network interface 2903 controlling the voltage setpoints of heater bank sets 1510A/1510B, 1510C/1510D, 1620A/1620B, 1620C/1620D, 1818A/1818D, 1818B/1818E, 1818C/1818F, 1920A/1920B, and 1920C/1920D, and eight analog inputs to network interface 2903 monitoring each heater bank set's current setpoint output HSP1-HSP8.

A preferable embodiment of heater control system 2955 would provide individual control of each of heater banks 1510A-1510D, 1620A-1620B, 1818A-1818D, and 1920A-1920D. Such an embodiment would include additional hardware lines to control each of the heater banks coupled to the electronic control system. In an embodiment using Emerson Spectrum 3 controllers, sixteen such controllers would be utilized and sixteen digital outputs of programmable logic controller 2902 would be needed to provide on/off control signals, sixteen digital outputs of programmable logic controller 2902 would be required to provide high/low output enable

signals, sixteen additional outputs of programmable logic controller 2902 would be utilized for heater FALSE signals, sixteen analog outputs from network interface 2903 would be needed to control voltage setpoints of the heater banks, and eight analog input signals to network interface 2903 would be utilized to monitor each heater banks current setpoint output.

11. Substrate Temperature Sensoring System 2960

Six Mikron temperature sensors (not shown) may be provided at various locations throughout the sputtering apparatus in a movable configuration to measure the temperature gradient over the surface of the substrate as it proceeds through various sections of the sputtering apparatus. The Mikron sensors provide 0-5 volt analog output signals TEMP1-TEMP6 through network interface 2903 for output to user interface 2904, thereby allowing the system operator to monitor at every cycle and react each heater bank 1818A-1818C output to maintain a uniform temperature gradient across the surface of the substrate as it proceeds through the apparatus. In general, sensors may be provided in chamber 16 or 18.

12. Power Supply Control System 2965

Power supply control system 2965 controls twenty-four (24) designated forty-eight (48) actual, in master-slave configuration), power supplies PS1A, PS1B, ... PS12A, PS12B which provide high power output to the sputtering magnetrons utilized in Chambers 20, 26 and 28 of sputtering apparatus 10. Power supplies PS1A-PS12B may be Model MDX-20X 20KW DC Plasma Power Supplies, Manufactured by Advanced Energy Industries Corporation,

Fort Collins, Colorado, capable of providing constant current, power, or voltage, and remote control thereof.

Control signals for power supply control 2965 are entirely controlled by computer 2901 through network interface 2903. One hundred sixty-eight inputs of network interface 2903 are utilized as follows:

# of INPUTS	Signal Designation	Function
24	PSLS1A-PSLS12A PSLS1B-PSLS12B	read power supply set point level
24	PSVO1A-PSVO12A PSVO1B-PSVO12B	read power supply voltage output
24	PSCO1A-12A PSC01B-12B	read power supply current output
24	PSO1A-12A PSO1B-12B	read power supply power output
24	PSTL1A-12A PSTL1B-12B	read sputtering target life calculation in power supply
24	PSARC1A-12A PSARC1B-12B	read power supply arc detect sense from power supply
24	PSSR1A-PSSR12A PSSR1B-PSSR12B	read power supply set point signal reached

One hundred six analog and digital outputs of network interface 2903 are provided to the power supplies as follows:

# of INPUTS	Signal Designation	Function
24	PSSP1A-12A PSSP1B-12B	(analog) power supply level set signals
24	PSM1.1-1.12 PSM2.1-2.12	(digital) mode control signals (12 x 2)
24	PSON1A-12A PSON1B-12B	(digital) on/off signals (12 x 2)
3	PSIV1-3	(digital) indicating vacuum chamber interlocks intact
3	PSIW1-3	(digital) indicating water interlocks intact
3	PSIX1-3	(digital) indicating heater cover interlocks intact
1	PSRES	(digital) emergency stop restore

The aforesaid input signals to network interface 2903, including level set point signals, voltage output signals, current output signals, power output signals, target life signals, arc out signals, and set point reached signals, yield precise data feedback for provision to both the user and the control system

software to monitor power supply performance. Interlock control signals PSTV1-PSTV3, PSTW1-PSTW3, PSTX1-PSTX3 are coupled to sensors (not shown) on interlock protective covers 2305 of sputtering apparatus 10 to cut out power supply output if the signals are tripped by an open interlock protective cover 2305 thereby preventing operator injury.

13. Coolant Control 2970

Circulating coolant fluid, such as water, is provided to various components of the sputtering apparatus to maintain temperatures within acceptable operating levels during production thereby forestalling rapid depletion of these system components. Specifically, coolant is provided to heaters 1512, shields 2230, compressors CY1-CY8, and sputtering cathodes 2222.

Coolant control system 2970 monitors the temperature level of the circulating coolant flow in the coolant system and controls the open/close states of coolant flow control valves. While the particular layout of the coolant flow system is not shown, it will be understood by those skilled in the art that any suitable number of coolant control schemes may be utilized within the scope of the present invention. The location of coolant flow sensors CHR1A/CHR1B - CHR4A/CHR4B; MAG5A/MAG5B - MAG8A/MAG8B; CAR9A/CAR9B - CAR12A/CAR12B, is shown in general form in Fig. 12.

Coolant flow control 2970 includes 24 magnetron cathode coolant flow sensors CHR1A/CHR1B - CHR4A/CHR4B; MAG5A/MAG5B - MAG8A/MAG8B; CAR9A/CAR9B -CAR12A/CAR12B, six sputtering shield coolant flow sensors CHRS1-CHRS2; MAG1-MAG2, and CARS1-CARS2, and six heat shield coolant flow sensors HSFS1-HSFS6. Each of these sensors

provides a digital output signal to one input of programmable logic controller 2902. Six water supply flow control valves CHSUV1-CHSUV2, MAGSUV5-MAGSUV6, and CARSUV9-CARSUV10, two supply valves per sputtering chamber, and six water return path valves CHRTV3 CHRTV4, MGRTV7-MGRTV8, CARTV11-CARTV12, two return path valves per sputtering chamber, are provided. Twelve outputs from programmable logic controller 2902 control the open/close states of the water supply valves and the water return path valves.

In addition, two main coolant on valves HH201 and HH202 are controlled by programmable logic controller 2902.

14. <u>Pirani and Ion Gauge Control 2975</u>

Gauge control 2975 also monitors the outputs of each pirani gauges PIR1-PIR20 and ion gauges monitoring residual ion contaminants in sputtering apparatus.

Vacuum pressure during the pumpdown process prior to crossover between mechanical pumps MP1-MP3, blowers BL1-BL3 and cryogenic pumps C1-C12, is monitored by twenty (20) pirani gauges PIR1 - PIR20 provided in the pumping conduits linking cryo pumps C1 - C12 with sieve valves SVIV1 - SVIV12, in chambers 12, 14, 20, 26, 28, 29 and 30 of sputtering apparatus 10, and in the conduit linking pump MP2 and blower BL2 with apparatus 10. Twelve pirani gauges PIR3-5, PIR7-9, PIR12-14 and PIR18-20 monitor pressure during outgassing in the region between cryo pumps C1-C12 to cryogenic roughing valves CR1-CR12. Seven pirani gauges PIR1, PIR2, PIR6, PIR11, PIR16, PIR15, and PIR17 to pressure monitor of chambers 12, 14, 20, 26, 28, 29 and 30.

Analog signals in the range of 0-10 volts are output from gauges PIR1-PIR20 to indicate the measured pressure

reading of each gauge and are provided to the network interface 2903. Twenty digital signals (designated PIR1 - PIR20) provided to programmable logic controller 2902 inputs to indicate the crossover point set for switchover between mechanical pumps MP1-MP3, blowers BL1-BL3, and cryogenic pumps C1-C12.

Four ion gauges IG1-IG4 (not shown) measure the level of background gas (i.e., water contamination) in chambers 14, 20, 26 and 28 of sputtering apparatus 10. Analog output signals ION1-ION4 are provided by gauge control 2975 network interface 2903 for output to user interface 2904 to provide the system operator with data for controlling the pump-down process.

In the preferred embodiment of the present invention, the pirani gauges and ion gauges are coupled through INFICON gauge monitor subsystems, manufactured by Leybold-Heraeus, Hanau, Germany, which provide an independent power source and hardware for use with the pirani gas and ion gauges discussed above.

15. Residual Gas Analyzers 2980

Residual gas analyzers RGA1 - RGA4 are utilized with sputtering apparatus 10 to monitor system status. Isolation of the residual gas analyzers RGA1 - RGA4 is controlled by the electronic control system by means of four isolation valves RGAV1 - RGAV4. Four dedicated outputs of programmable logic controller 2902 are provided to residual gas analyzers RGA1-RGA4 to open and close analyzer isolation valves RGAV1-RGAV4.

Sensors RGAS1-RGAS4 are provided to four inputs programmable logic controller 2902 to provide a status indication of residual gas analyzer valves RGAV1-RGAV4 indicating valve's opened or closed state.

System Control Software

Figure 30 is an overview flow-chart diagram of the system control software of the present invention. It should be noted that the following description is intended to be a general discussion of the capabilities and functions of the system software. Specific software functions and capabilities will be understood by one skilled in the art after a review of the source code in Sections M and N. It should be further noted that the following discussion does not differentiate between those functions controlled by programmable logic controller 2902 and computer 2901. As will be recognized by those skilled in the art, any of the functions described with respect to Figures 30-32 may be performed by a single process controller or multiple process controllers. The preferred embodiment for performing each of the functions outlined in Figure 30 is shown in Figure 29 and detailed in the source code sections.

As shown in Figure 30, the software architecture is designed to allow both manual and automatic control of select system functions. Certain processes are automated while others depend on comprehensive feedback provided to the user (system operator) allowing the system operator monitor and react to such feedback to make adjustments in particular operating parameters (such as heater power level, and sputtering power supply output levels, etc.) to obtain optimal sputtering characteristics.

In the embodiment of the control software shown in Figure 30, the user or system operator manually controls: gas flow valves GF1-GF8, residual gas analyzer isolation valves (RGAV1-RGAV4); passby and dwell heater setpoints (HSP1-HSP8); power supply and

motor speed setpoints (PSSP1A-PSSP12B, DMOTLO1-DMOTLO21, DMOTHI1-DMOTHI21); the amount of time spent by a substrate in dwell heater chamber 14 (HTR1TMR); the amount of time the passby heater is on while a pallet is passing therethrough (HTR2ON_DLY); and an emergency stop and pause latch commands.

In addition, other elements such as coolant control, venting control, heater control, power supply control and cryo-pump system evacuation are manually initiated. Specifically, coolant control functions 3070 initiate coolant flow to heater shields 2230 and cathodes 2222-2225 in chambers 20, 26, and 28 upon manual power up of the system. Further, manual control is provided for some heater control functions 3075, such as selection of low and high heater setpoints. Manual control of the heater setpoints allows the user to monitor the output of the (Mikron) substrate temperature sensors and make adjustments to individual heater bank setpoints and/or substrate heating duration timers to achieve an optimal thermal effect on individual substrates moving through heater chambers 14 and 16. Additionally, manual control of some chamber vent functions 3015 allows for apparatus 10 to be vented in whole or in sections for machine maintenance.

Feedback block 3012 provides the user with such data as: argon pressure readout, substrate temperature, power supply output setpoints, motor speed setpoints, an ion & pirani gauge readouts. Additional data, such as that described above with respect to Figure 29, is also provided to the system operator.

Referring to Figure 30, apparatus 10 is generally maintained in a standby state 3028 at full vacuum, e.g., 1 x 10^{-7} Torr. At system standby 3028, apparatus 10 has been pumped down to a high vacuum level by mechanical

pumps MP1-MP3, blowers BL1-BL3 and cryopumps C1-C12. The system stand-by condition is usually maintained due to the time required to perform total system pumpdown.

As noted briefly above, system maintenance 3082 may be performed when apparatus 10 is on a section by section basis while venting only those sections necessary for maintenance purposes. In such cases, apparatus 10 is divided into five sections. Generally these sections comprise: chambers 12-14; chambers 18-24A; chambers 22B-24B; chambers 22D-24C; and chambers 29-30. Each of the five sections can be individually vented and pumped down under user control as required, depending on what access to apparatus 10 is required. In this regard, the chamber vent control functions 3015 allow the user to individually control of the opened or closed state of chamber vent valves CV1-CV5 depending on which section is to be vented. Automated section pump sequences 3010 are provided to control roughing down of each section 1-5 using pumps MP1-MP3 and blowers BL1-BL3, and high vacuum valves sequence 3030 to control valves HV1-HV12 as required, to reduce individual sections to high vacuum. Section pump sequence 3010 also ensures that doors D1-D12 are in their required opened or closed states with respect to the pumping or venting of the particular stage as required:

	DOORS CLOSED	
STAGE	PUMP	VENT
1	D1 - D3	D1 - D4
2	D4 - D6	D3 - D5
3	D5 - D8	D6 - D7
4	D7 - D10	D8 - D9
5	D9 - D12	D10 - D12

In the instance where chambers 12-30 of apparatus 10 have been fully vented and are at ambient atmosphere, an automated pump down sequence is provided to reduce the pressure of chambers 12-30 to approximately

50 mTorr. The user initiates the pump down system enable sequence 3020 which provides a check and setup for the pump-down process. A pump down timer PDSTMR is initialized which allows the pump down enable process to run for a maximum of 60 seconds before issuing a fault.

The enable process (PDSE) 3022 comprises: closing RV1-RV5; checking RVS1, RVS3, RVS5, RVS7, RVS9 to ensure valves RV1- RV5 are closed; enabling MP1-MP3; opening doors D2 - D11 (within a limit of 3 seconds before outputting a fault); closing doors D1 and D12; and enabling compressors CY1-CY8. A pirani gauge check 3024 is performed to ensure that PIR2, PIR6, PIR11, PIR16, and PIR15 are less than 125 mTorr (or equivalent preset level between 100-250 mTorr) before the system opens baffles 1210 and 1214. At this point, apparatus 10 has reached a roughed down state 3028 wherein each chamber 12-30 is at a pressure of approximately 50 mTorr, and blowers BL1-BL3 and mechanical pumps MP1-MP3 are disabled (3029).

To reduce the pressure in apparatus 10 to a level conducive to sputtering, high vacuum valves HV1-HV12 must be fully opened to allow cryogenic pumps C1-C12 to pump apparatus 10. This sequence 3030 is initiated by a manual user input 3030a assuming the system has reached the roughed, crossover point 3028. At stage 3030, pirani gauges PIR2, PIR6, PIR11, PIR16, and PIR15, corresponding to individual pump sections 1-5, are checked before opening each respective high vacuum valve sets HV1-HV2, HV3-HV5, HV6-HV8, HV9-HV11, and HV12, respectively associated therewith. Once high vacuum valves HV1-HV12 are opened, cryogenic pumps C1-C12 will evacuate the internal environment of chambers 12-30 to a pressure of approximately 1×10^{-7} - 2×10^{-7} Torr.

When apparatus 10 has achieved a pumped down state 3032, the auto run preparation mode 3034 must be initiated by a manual user input 3032a. Auto run preparation sequence 3034 involves: providing argon backfilling by opening GF3, GF5, GF7, and GF8; checking for no doorfaults ($\overline{\text{DOORFAULT}}$); check/enable mechanical pumps MP1 & MP3, and blowers BL1 and BL3; check and set dwell and passby heaters to low power setpoints; check and/or set doors D1-D3, D10-D12 closed, and doors D4-D9 open; and throttle HV2-HV12.

Once the system is prepared for auto run mode operation, a user input 3035 is required before the auto run mode 3050 is enabled. If the user input is made and the system is prepared, the auto mode is enabled. Auto mode functions 3050 include throttling high vacuum valves HV2-HV12 and enabling the transport stages of return conveyor path 50. In addition, auto mode 3050 includes the automatic run sequence 3200 controlling motor assemblies, door operation, load/exit lock pumping and venting, and high power supply/heat control described in Figure 32. Sputtering power supplies PS1A-PS12B will have been manually preset to low power. It is noteworthy that coolant control sensors CHR1A-CHR4B, MAG5A-MAG5B, and CAR9A-CAR12B must indicate the presence of circulating coolant in cathodes 2222-2225 before power supplies PS1A-PS12B will be enabled.

Upon exiting auto mode 3050, apparatus 10 returns to a standby state wherein the dwell and passby heaters in chambers 14 and 16, respectively, are automatically switched off and auto run mode is disabled.

The software also provides a number of fault flags to the user to allow the user to correct potential problems or to hold processing of other logic rungs until correction of the fault is completed. Such faults

may include, for example, argon gas flow failure detection (NO ARGON); a failure in communications between computer 2901 and programmable logic controller 2903 (NO FIX COMM); motor assembly faults; internal system pressure failures (NO VACUUM); cryogenic pump failures (CRYO > 20°K); load lock and exit lock venting problems (LLVENT > 60 s, EXLOCK VENT > 60s); open protective covers on sputtering chambers 20, 26, 28, (INTERLOCKS); mechanical pump and blower failures (MP FAIL); power supply arc (ARC DETECT); air supply failsafe (APS); heater alarm/fault; power supply setpoint alarms; door faults (DOORFAULT); valve faults; and coolant flow faults.

An automated process 3100 for regenerating (cleaning and purging) cryo pumps C1-C12 is also provided in the software of the present invention. Cryogenic pump regeneration process 3100 will be discussed with respect to Figure 31. Figure 31 is a flowchart showing the cryogenic pump regeneration process for a single cryogenic pump, C1. The regeneration processes for pumps C2-C12 are identical, using corresponding valves, gauges, and heaters, coupled to respective pumps C2-C12 as applicable, for each pump C2-C12 being regenerated.

In general, the cryogenic pump regeneration comprises raising the temperature of the cryogenic pumps, supplying the pumps with warm nitrogen, and enabling mechanical pump MP2 and blower BL2 to flush the contaminant materials agitated by the nitrogen flow out of the cryo pumps.

Cryogenic pump regeneration process 3100 is manually initiated by a user 3110. User initiation of the cryogenic pump regeneration process preferably enables simultaneous regeneration of all twelve cryogenic pumps 3115. The initial regeneration step 3120 entails

closing HV1 and initiating a sieve trap timer with a total duration of 5400 seconds.

The sieve timer initiates enables sieve heater SIVHTR1 for 3600 seconds (3121, 3122). Further, mechanical pump isolation valve MP2IV is checked and sieve valve SVIV1 is opened (3124) for a duration of 5400 seconds (3126); valve SVIV1 is closed at the expiration of 5400 seconds (3125). In addition, the purge sequence 3130 is initiated.

Purge sequence 3130 opens nitrogen flow valve NIF1 and enables nitrogen heater NIH1. Sequence 3130 waits until the cryogenic pump has reached a temperature of 290° K before initiating the purge timer with a duration of 7200 seconds. Purging of the cryogenic pump thereafter continues for 7200 seconds. When complete, NIF1 and NIH1 are closed and roughing sequence 3140 begins.

The roughing sequence involved initially checking to ensure that line pressure (PIR10) is TRUE, BL2 is enabled and PIR3 outputs false (pressure less than 250 mTorr). If these condition are met, cryo roughing valve CR1 and sieve valve SVIV1 are opened, and a roughing timer having a duration of 600 seconds is started. If roughing takes place for longer than 600 seconds a fault is generated. Otherwise, the system waits for PIR3 to output a TRUE condition before closing CR1.

After CR1 is closed, a ROR timer waits for 30 seconds to ensure PIR3 remains TRUE. If at any time before the expiration of thirty seconds a $\overline{\text{PIR3}}$ signal is received, the system counts one and returns to restart the roughing sequence. The system will perform ROR test 3150 generally for up to five cycles (and up to 20 cycles for pump C1) before outputting a fault.

If PIR3 remains TRUE and the ROR timer = 30 seconds, the process goes to cool down -- allowing 7200 seconds for the cryogenic pump to reach a temperature of ≤ 20°K. If the cryogenic pump does not reach 20° K within 7200 seconds, a fault is generated.

Figures 32A-32D are a logical diagram of one component of the electronic control system software showing input/output and process control of the auto run mode 3200 controlling substrate movement through apparatus 10. In the logical flow diagram of Figures 32A-32D, horizontal lines indicate software logic flow in relation to time, with time increasing in the direction of the arrows shown therein; vertical lines generally represent decision points.

As shown in Figures 32A and 32D, the system control software of the present invention utilizes motor control 2910, position sensors 2915, door control 2920 and pump valve and vent system 2930, to control movement of a substrate through sputtering apparatus 10. The addresses used in Figures 32A-32D correspond to those discussed above with respect to the functional elements of the electronic control system.

As shown in Figures 32A-32D, start point 3200 in entrance lock loop 3210 of the software represents a system status condition wherein sputtering apparatus 10 is prepared for a substrate to enter load lock 12. Start point 3200 may denote the first substrate entering apparatus 10, or may represent a point wherein a prior substrate cleared load lock 12 and passed into heater 14.

At the start point 3200, roughing valves RV1-R5 are closed, doors D4-D9 are open, doors D1-D3, D10-D12 are closed, and chamber vent valves CV1-CV5 are closed. The software also checks for a TRUE output from PIR17, RV5,

and DROP10S, indicating, respectively, chamber 30 at crossover pressure, the closed state of roughing valve RV5, and whether door D10 is open.

When a substrate is moved into position at entrance platform 210, the system software is prepared to begin entrance sequence 3210. Position sensors SEN1-SEN3 must indicate a TRUE condition, signaling the presence of a pallet, in order for the software system to proceed. If entrance lock loop 3210 is in a state wherein a substrate has passed out of dwell heater chamber 14, point 3215 in the logic flow line, timer VDDR2CL, which runs for 2 seconds to verify that door D2 has closed, must have completed its sequence in order for processing of that substrate to proceed. Generally, when VDDR2CL is initiated, a substrate will be waiting at entrance platform 210. Thus, input conditions indicated at 3212 will be TRUE and timer VDDR2CL will control initiation of the software logic. After the target position is verified, door close sensor DRCL1S is checked to ensure door D1 is closed, and roughing valve sensor RVS2 is checked to ensure roughing valve RV1 is closed. Additionally, pressure switch PS2 must read FALSE ($\overline{\text{PS2}}$), sensor SEN1 is redundantly checked for a TRUE output, and position sensors SEN4-SEN6 must read FALSE to ensure the absence of a substrate in load lock 12. When all the above-mentioned conditions are met, signal OPCV1 is directed to open chamber vent valve CV1 to vent load lock 12. In logical terms, the condition -- DRCL1S AND RVS1 AND $\overline{\text{PS2}}$ AND $\overline{\text{SEN4}}$ AND $\overline{\text{SEN5}}$ AND SEN6 -- must be TRUE to open CV1, as indicated by the input description 3212. Signal OPCV1 causes pressure switch PS2 to output a TRUE state, and pirani gauge PIR1 to output a FALSE state (e.g., pressure above crossover level).

A timer CV1_DLY runs for 1 second before a signal is sent to close CV2. Timer PAL_GAT_TT is a 155 second duration timer provided to ensure a specified amount of time passes between the entrance of successive pallets into load lock 12. Timer PAL_GAT_TT is initialized when door D1 is closed, as signified by $\overline{\text{DROP1}}$ or $\overline{\text{DROP1S}}$, such signals being generally output after door D1 is closed subsequent to entrance of a substrate into load lock 12, as shown by loop 3214. If PAL_GAT_TT is FALSE ($\overline{\text{PAL\_GAT\_TT}}$ e.g., timer complete), and PS2, SEN3, and SEN5, are TRUE then signal DROP1 is sent to open outer door D1 to receive a substrate into apparatus 10. Signal DROP1 will cause door open sensor DROP1S to output TRUE, indicating door D1 is, in fact, open. Prior to activating motor assemblies M3 and M4, the logical condition -- (SEN3 or SEN4) AND $\overline{\text{SEN6}}$ AND DRCL2S -- must be TRUE. When this condition is met, motor assemblies M3 and M4 are activated to move the substrate at high motor setpoint speed from entrance platform 210 of the sputtering apparatus into load lock 12. Movement of the substrate will cause sensors SEN4 and SEN6 to output TRUE, and sensors SEN1 and SEN3 to output FALSE. When sensors SEN3 and SEN6 output FALSE and TRUE conditions, respectively, signaling the presence of the substrate in chamber 14, signal DRCL1 is provided to close outer door D1. Signal DRCL1 causes DROP1S to output a FALSE condition indicating door D1 is closed, and enabling timer PAL_GTE_TT, as discussed above.

Subsequently position sensor SEN6, and door close sensors DRCL1S and DRCL2S, when TRUE, enable timer SOFRUF for 1 second, thereby delaying opening of roughing valve RV1. When timer SOFRUF has completed, and the logical condition -- DRCL1S, $\overline{\text{PIR1}}$, $\overline{\text{CV1}}$, BL1, AND

MPIIVOP -- is TRUE, signal OPRV1 is sent to open roughing valve RV1.

High speed, explosive pumping occurs in load lock 12 until such time as the preset requisite chamber pressure is achieved, causing PIR1 to output TRUE. Opening RV1 causes sensor RVS1 to output TRUE, enabling timer DROP2_DLY to run for two seconds to ensure pump MP1 and blower BL2 have sufficient time to pump load lock 12 down. When timer DROP2_DLY is done and PIR1 is TRUE, RVS1 outputs TRUE and PS2, FALSE. At the same time, signal OPTDR2 is sent to open door D2 to allow the substrate to move between load lock 12 and heater chamber 14.

Before motor assembly M4 will engage, sensor SEN6 must be TRUE, and SEN9 FALSE, to indicate the presence and absence of a target in load lock 12 and heater chamber 14, respectively. If all conditions are met, motor assembly M4 is activated at high speed setpoint; somewhat redundantly, the logical condition -- (SEN6 OR SEN7) AND $\overline{\text{SEN9}}$ -- must be TRUE in order for motor assembly M5 to engage at high speed. A substrate is thereby transferred between load lock 12 and heater chamber 14. The engagement of motor assembly M4 and M5 will cause sensors SEN7-SEN9 to output TRUE, and sensor SEN6 to become FALSE. Simultaneously, if the logical condition -- ($\overline{\text{SEN4}}$ OR SEN6) AND DR3CLS, SEN9, AND SEN7 -- is TRUE, signal DRCL2 will be sent to close door D2. Signal DRCL will cause sensor DRCL2S to become TRUE, thereby initiating timer VDDR2CL as discussed above.

At point 3215 in the logic diagram, the software and sputtering apparatus 10 are prepared to receive an additional substrate in load lock 12 while proceeding with the sputtering process on the substrate now present in heater chamber 14. Assuming position sensors SEN1

and SEN3 indicate the presence of a substrate, loop 3210 will return to start position 3200 and may continuously receive additional substrates while processing of other substrates continues at different points in apparatus 10 in accordance with the following discussion.

At this point, it is notable that the aforesaid redundant signal and sensor readings take on additional significance when multiple targets will be moving through the system. These fail safe sensor readings are provided to ensure smooth operation of apparatus 10, and the absence of pallet collisions or errors within the apparatus.

The substrate present in heater chamber 14 continues through apparatus 10 under the control of the system software as follows. Door close sensors DRCL2S and DRCL3S to ensure doors D2 and D3 are closed. Again, sensor SEN9 is checked to ensure the presence of a pallet in heater chamber 14. If all such conditions are true, HTR1TMR engages for 72 seconds; simultaneously, if no water faults are detected ($\overline{\text{HSFGIF}}$) heaters 1510A-1510D are driven to high power to act on the substrate present in chamber 14. Heating of the substrate in heater chamber 14 occurs for a specified duration as determined by HTR1TMR.

Upon completion of 72 seconds, two heater timers are initiated: HTRDLYTMR and HTR2ONDLY. If HTR1TMR is completed and no water faults are present ($\overline{\text{HSFGIF}}$), timer HTR2ONDLY, having a duration of 26 seconds, is enabled to control initiation of passby heaters 1818A-1818F and fault generation signal H2F upon its completion. Simultaneously HTRDLYTMR, having a duration of 25 seconds is enabled and measures out the substrate soak time in dwell heater chamber 14. Upon completion, timer HTRDLYTMR initiates the motor control and venting

sequence 3220 which runs simultaneously with heater control timing sequence 3225, generally illustrated in Figure 32B. After 25 seconds, baffle 1210 is throttled by signal HV1_2 and timer DR3DT, having a duration of 5 seconds, is initiated. If $\overline{\text{DROP3S}}$ is TRUE and timer DR3DT is done, signal DROP3 is provided to open door D3 to allow the substrate to pass from heater chamber 14 into first buffer/passby heater chamber 16.

As will be noted by following parallel processes 3220 and 3225, heater banks 1818A-1818E will have been initiated by HTR2ONDLY prior to the substrate's entry into chamber 16 and are timed to remain on until a point at which the substrate is exiting chamber 16. DROP3 will cause door open sensor DROP3S to indicate door D3 is in an open state. When the logical condition -- SEN9, $\overline{\text{SEN13}}$, $\overline{\text{SEN15}}$ AND DROP4S -- is TRUE, motor assembly M5 is enabled at slow setpoint speed. When the logical condition -- DROP4S, $\overline{\text{SEN12}}$ AND (SEN9 OR SEN10) -- is TRUE, motor assembly M6 is activated at slow setpoint speed to pass the substrate through from heater chamber 14 first to buffer passby heater chamber 16.

As the substrate is passed through chambers 14 and 16, SEN10-SEN13 will output TRUE and SEN7, FALSE. Subsequently, if the condition -- (SEN11 OR SEN12) AND DROP4S AND $\overline{\text{SEN15}}$ -- is TRUE, motor assembly M6 is enabled, and if -- (SEN12 OR SEN13) AND DROP4S AND $\overline{\text{SEN15}}$ -- is TRUE, motor assembly M7 is enabled at slow setpoint speed to pass the substrate from passby chamber 16 into dwell chamber 18. It will be noted that movement of the substrate into chamber 18 triggers SEN13, which in turn initiates timer HTR2OFF. HTR2OFF is set with a duration of 13 seconds, a period which, when used with the motor setpoint speeds set out above (Table 1), shuts off passby heaters 1818A-1818E before

the substrate fully exits chamber 16. This is to avoid overheating the trailing edge of the substrate, as discussed above. It is further noted that heater fault timer H2F runs for duration of 70 seconds before outputting a fault, indicating that the heater banks have been on too long, possibly resulting in burnout of the heating elements.

In like manner, movement of the substrate through sputtering apparatus 10 by motors M7-M19 continues as shown in Figs. 32C and 32D with associated inputs and outputs shown therein having like affect as the I/O discussed above. Each input condition shown must be met in order to activate subsequent motor assemblies along the substrate's path through sputtering apparatus 10. Likewise, each signal causes an output state change for each sensor or value indicated. In like manner, only those motor assemblies M6/M7, M7/M8, M8/M9, M9/M10, M10/M11, etc., necessary for particular platforms to transport the substrate present at that location are activated. Individual motor assembly speeds are set as discussed in Table 1 to vary the velocity of the substrate through particular chambers of sputtering apparatus 10 as the sputtering process requires. As noted with respect to Figures 32A-32D, and Table 1, motor assembly pairs operate at the same speed in order to assure smooth substrate transport.

As shown in Figure 32D, an exit lock loop 3250, similar to entrance lock loop 3210 discussed above, allows sequential passing of substrates through exit lock chamber 30 to ensure the integrity of the evacuated environment in sputtering apparatus 10 is maintained.

Beginning at point 3252, if -- DRCL10S, $\overline{\text{CV5}}$, $\overline{\text{SEN54}}$, AND RVS9 -- are TRUE, (indicating door D10 is closed, chamber vent CV5 is closed, substrate at SEN54, and

roughing valve RV5 is open, respectively), signal DROP11 is sent to open door D11, thereby causing sensor DROP11S to output TRUE. If -- (SEN51 OR SEN52) AND $\overline{\text{SEN54}}$ -- then, motor assemblies M19 and M20 are enabled at high setpoint speeds, causing SEN52-SEN54 to be TRUE and SEN51 to be FALSE. Sensor SEN54 enables a signal to close RV5, thereby causing RVS9 to output TRUE, and also enables a signal to close door DR11, causing DRCL11S to output TRUE. A delay timer VDDR11CL delays CV5's closing for 1 second to allow venting of exit lock 30. Once the above conditions are met, and sensor SEN54 is TRUE (pallet in exit lock 30) and DRCL12S is TRUE (door D12 closed), chamber vent CV5 is opened. Subsequently, if roughing valve RVS9 is shown as TRUE, sensor SEN57 indicates FALSE, door close sensor DRCL11S and sensor SEN54 indicate TRUE, and pressure switch PS6 indicates TRUE, exit lock 30 will be vented to atmosphere (opening CV5) and a signal DROP12 will be sent to open door 12, thereby resulting in door open sensor DROP12S outputting a TRUE condition. When pressure switch PS6 outputs a TRUE condition, timer CV5_DLY having a duration of 1 second, will be enabled. Timer CV5_DLY will, upon completion, output a signal to close chamber vent valve CV5.

Once door D12 is open, if sensor SEN54 is TRUE, sensor SEN57 output FALSE, and door sensor DRCL11S outputs TRUE, motor assembly M20 will be enabled to proceed at its fast speed setpoint. Simultaneously, if sensor SEN54 or SEN55 output TRUE, and sensor SEN57 outputs FALSE, motor M21 will be enabled to proceed at its fast setpoint. The substrate present in exit lock 30 will thereafter proceed to exit platform 214.

At point 3260 in the software logic flow, the software branches in two directions, enabling the

substrate to proceed to robot unloading station 45, if the logical condition -- SEN56 OR SEN57 -- is TRUE thereby enabling motor assembly M21 to proceed at its fast setpoint, or looping to prepare to receive an additional substrate in exit lock 30. To prepare to receive an additional substrate, chamber vent CV5 must be closed. Subsequently, sensor SEN54 must output FALSE and door close sensor DRCL11S output TRUE in order for a signal to be sent to close door D12. If the logical condition -- MP3IVOP, $\overline{\text{CV5}}$, BL3, $\overline{\text{PIR17}}$, $\overline{\text{SEN54}}$, AND DRCL11S -- is TRUE, a signal will be sent to open roughing valve RV5 to pump down chamber 30 to prepare for receiving an additional pallet therein. Opening roughing valve RV5 will cause roughing valve sensor RVS10 to output TRUE, and pirani gauge PIR17 will output TRUE when chamber 30 is below crossover. Apparatus 10 is then in a state which exists at software logic point 3252 to prepare to receive an additional substrate in exit lock 30.

As should be understood by those skilled in the art, the particular cross-over pumping levels described above with respect to the software of the present invention may be varied as desired to achieve the requisite atmospheric conditions in apparatus 10 for the particular sputtering application desired. In the preferred embodiment of the present invention, the pirani gauge pressure setpoints outputting digital signals to programmable logic controller 2902 are shown in Table 2:

TABLE 2

Gauge	Setpoints (in mTorr) Upper	Lower
PIR1	125	100
PIR2	125	100
PIR3	80	50
PIR4	80	50
PIR5	80	50
PIR6	125	100
PIR7	80	50
PIR8	80	50
PIR9	80	50
PIR10	1000	50
PIR11	125	50
PIR12	80	50
PIR13	80	50
PIR14	80	50
PIR15	150	125
PIR16	125	100
PIR17	125	100
PIR18	80	50
PIR19	80	50
PIR20	80	50

It should be further understood by those skilled in the art that a multitude of control schemes and sensor I/O arrangements may be utilized within the scope of the present invention to provide an automated control sequence over a substrate or substrates moving through a sputtering apparatus in accordance with the present invention. The above-described automated run mode 3200 provides for a multitude of pallets, optimally seven pallets, moving through apparatus 10 as discussed in the present specification. It should be understood that all such modifications are contemplated as being within the scope of the invention described herein.

L. Process In General

Examples 1 and 2 illustrate process parameters for sputtering apparatus 10 to produce 950 Oe and 1200 Oe, respectively, hard drive disks.

Example 1

As illustrated in Figure 2, once engaged by substrate carrier 1450, pallet 800 loaded with disk substrates 510 proceeds through door D1 into load lock chamber 12. After pallet 800 enters load lock chamber 12, door D1 closes. Load lock chamber 12 is pumped down to 50 microns (50 mTorr) in 20 seconds by mechanical roughing pump MP1. Door D2 opens, allowing pallet 800 to proceed at 6 ft/min into dwell heating chamber 14. Dwell heating chamber 14 has already been evacuated by cryo pump C1 to 10^{-5} Torr (0.01 microns). As pallet 800 proceeds through the chamber, it triggers proximity position sensors which in turn initiate heaters. Heating lamp warmup time is negligible since, during sputtering operations, the lamp filaments are kept warm by a low power level. Pallet 800 and disk substrates 510 soak in dwell heating chamber 14 for 30 seconds with the temperature about 220°C. During this soak period, the heating power applied is 3.1 kW per bank. Argon enters through gas manifolds to backfill dwell heating chamber 14 and equalize the internal pressure before door D3 opens, allowing pallet 800 to proceed. This backfill also maintains pressure equilibrium throughout the apparatus, essential to stabilizing sputtering processes. Door D3 opens to passby heating chamber 16, triggering the initiation of passby heaters. Pallet 800 enters passby heating chamber 16 and after clearing sensor SEN10, triggers the closure of door D3. This chamber also has been evacuated by cryo pump C2 to about 10^{-5} Torr (0.01 microns). Passby heating banks 1818A-1818F operate using 7.6 kW per bank. Lamps 1514 on the leading edge of the pallet reduce power as pallet 800 exits into dwell chamber 18 at 6 ft/min. Pallet 800 proceeds through dwell chamber 18 which has already been

evacuated by cryo pump C3 to 10^{-5} Torr. The pallet proceeds at 6 ft/min past heat reflective panels 2120.

Pallet 800 enters chromium sputtering chamber 20 maintained at 9-12 microns (9-12 mTorr) of argon pressure with argon flow at 300 standard cubic centimeters per minute (sccm). Pallet 800 travels at 6 ft/min as it passes sputtering targets 2226-2229. The sputtering power is 7.5 kW per cathode, with a 1,000 Å thick chromium film deposited. Transport speed through dwell chamber 22A, buffer chamber 24A and dwell chamber 22B is 12 ft/min through open doors D5 and D6. These three chambers are pumped by cryo pumps C4, C5, and C6. Pallet 800 enters magnetic sputtering chamber 26 maintained at 9-12 microns [9-12 mTorr) of argon by cryo pumps C6 and C7 with argon flow at approximately 400 sccm. The transport speed through sputtering chamber 26 is 6 ft/min. The sputtering power is 7.5 kW per cathode, depositing a 800 Å thick CoCrTa film. Transport speed through dwell chambers 22C and 22D and buffer chamber 24B is 6 ft/min. Dwell chambers 22C, 22D and buffer chamber 24B are pumped by cryo pumps C7, C8 and C9. Pallet 800 enters carbon sputtering chamber 28 maintained at 9-10 microns (9-12 mTorr) by cryo pumps C9 and C10 with argon and up to 15% hydrocarbon gas like ethylene or acetylene flowing at 100 sccm. The transport speed is 2.8 ft/min as the pallet passes the sputtering targets in carbon sputtering chamber 28. Sputtering power is 7 kW per cathode with a film thickness of 350 Å. Transport speed through dwell chamber 22E, buffer chamber 24C and exit buffer chamber 29 is 6 ft/min with doors D9 and D10 opening and closing sequentially to allow pallet 800 to proceed. Dwell chamber 22E is pumped by cryo pumps C10 and C11, buffer chamber 24C and exit buffer chamber 29 are pumped by

cryo pump C12. Argon is backfilled into exit buffer chamber 29 by cryo pump C12 to equalize the pressure differential existing with respect to exit lock chamber 30. Pallet 800 next proceeds through exit lock chamber 30 which is vented to the atmosphere by chamber vent valve CV5 in 10 seconds. Pallet 800 then proceeds to robotic unloading station 45.

To produce a 1,200 Oe magnetic film, the soak time in dwell heating chamber 14 may be increased to about 50 seconds to allow the substrate temperature to increase to approximately 250°C and/or the pallet transport speed through chromium sputtering chamber 20 may be reduced in order to allow a thicker deposition of a chromium underlayer. Adjustment of soak time and/or substrate temperature parameters depends on the life cycle of the pallet -- a pallet which has proceeded through numerous sputtering runs will have a thicker film deposition which can absorb more water and consequently would have more water to outgas before film deposition.

The many features and advantages of the apparatus and process of the present invention will be apparent to those skilled in the art from the description of the preferred embodiments and the drawings.

Thus, a high throughput process and apparatus which accomplishes the objectives of the invention and provides the above advantages by providing a comprehensive in-line sputtering system utilizing matched component elements to process multiple large single sheet or pallet transported discrete substrates in a continuous, variable speed, sputtering process has been described. Such an apparatus and method can process up to 3,000 95mm disk substrates, and 5,300 65mm disk substrates, per hour. Such high volume production offers both high volume production and, consequently,

cost savings per disk on the order of $4.00 per disk over prior art sputtering apparatus and processes. As noted throughout this specification, such an apparatus and process is achieved through a novel combination of process and structural elements involved in disk preparation, provision of a sputtering environment, transportation of substrates through the sputtering environment at rapid speeds and in a contaminant free manner, heating the substrates to optimal thermal levels for sputtering, and sputtering the substrates through a series of substantially isolated, non-crosscontaminating sputtering steps.

SECTION M

Number of Program Files

Name	File	Sub-Program Description	Size: Elems	Bytes
	0	[SYSTEM DATA STORAGE HEADER]	32	64
MAIH_PRGRM	2	THE MAIN PROGRAM	7205	36456
CRYO_REGEN	3	CRYO REGENERATION RUNGS	1942	10475
RETRN_CNVR	4	THE RETURN CONVEYOR	550	2683
FAULTS	5	THE FAULT RUNGS	798	5114
TECH_RUNGS	6	THE TECHNICIAN RUNGS	370	2578

111


```
Rung #000
|FIRST SCAN                                                                 FIRST SCAN   |
|AFTER POWER                                                                AFTER POWER  |
|LOSS                                                                       LOSS         |
|1ST_PASS                                                                   PWR_ON_DLY   |
|     S:1                                                                       B3       |
|----] [----------------------------------------------------------------------(L)-------|
|     15                                                                        444      |
B3/444 - ] [ - - File #2 MAIN_PRGRM -  155
        ]/[ - - File #2 MAIN_PRGRM -  115,117,118,119,120,121,122,123,124,125,126,127,128,129,130,131,132,133,134,135,136,137,138
        -(L)- - File #2 MAIN_PRGRM -  0
        -(U)- - File #2 MAIN_PRGRM -  1
Rung #001
|                                                                           FIRST SCAN   |
|POWER ON DELAY                                                             AFTER POWER  |
|DEFEAT                                                                     LOSS         |
|PWR_ON_DLY_DFT                                                             PWR_ON_DLY   |
|      B3                                                                       B3       |
|----] [----------------------------------------------------------------------(U)-------|
|     268                                                                       444      |
B3/444 - ] [ - - File #2 MAIN_PRGRM -  155
        ]/[ - - File #2 MAIN_PRGRM -  115,117,118,119,120,121,122,123,124,125,126,127,128,129,130,131,132,133,134,135,136,137,138
        -(L)- - File #2 MAIN_PRGRM -  0
        -(U)- - File #2 MAIN_PRGRM -  1
Rung #002
|BLOCK TRANSFER  BLOCK TRANSFER                          BLOCK TRANSFER                     |
|WRITE           READ                                    WRITE ENABLE                       |
|BT_WRITE        BT_READ                                 BTWRITE                            |
|     N11:1          N10:0                               +-BTW--------------------+         |
|----]/[-------------]/[---------------------------------+BLOCK TRANSFER WRITE    +-(EN)-|
|     15             15                                  |Mod Type:        1771-DB|         |
|[2]             [3]                                     |           BASIC module +-(DN) |
|                                                        |Rack:                  4|         |
|                                                        |Group:                 7+-(ER) |
|                                                        |Module:                0|         |
|                                                        |Control Block:     N11:1|         |
|                                                        |Data File:         N7:21|         |
|                                                        |LENGTH:               21|         |
|                                                        |Continuous:            N|         |
|                                                        +-------------------------+         |
N11:1/15 - ]/[ - - File #2 MAIN_PRGRM -  2,3
N7:21/3 - -( )- - File #2 MAIN_PRGRM -  532
N7:21/4 - -( )- - File #2 MAIN_PRGRM -  533
N7:21/5 - -( )- - File #2 MAIN_PRGRM -  534
N7:21/6 - -( )- - File #2 MAIN_PRGRM -  535
N7:21/7 - -( )- - File #2 MAIN_PRGRM -  536
N7:21/8 - -( )- - File #2 MAIN_PRGRM -  537
N7:21/9 - -( )- - File #2 MAIN_PRGRM -  538
N7:21/10 - -( )- - File #2 MAIN_PRGRM -  539
N7:21/11 - -( )- - File #2 MAIN_PRGRM -  540
N7:21/12 - -( )- - File #2 MAIN_PRGRM -  541
N7:21/13 - -( )- - File #2 MAIN_PRGRM -  542
N7:21/14 - -( )- - File #2 MAIN_PRGRM -  543
N7:21/15 - -( )- - File #2 MAIN_PRGRM -  544
```

```
Rung #003
|BLOCK TRANSFER  BLOCK TRANSFER                                         BLOCK TRANSFER              |
|WRITE           READ                                                   READ ENABLE                 |
|BT_WRITE        BT_READ                                                BTREAD                      |
|   N11:1           N10:0                                               +-BTR-------------------+   |
|----|/|-----------|/|--------------------------------------------------+BLOCK TRANSFER READ    +-(EN)-|
|     15            15                                                  |Mod Type:       1771-DB|    |
|[2]             [3]                                                    |          BASIC module+-(DN) |
|                                                                       |Rack:                 4|    |
|                                                                       |Group:                7+-(ER) |
|                                                                       |Module:               0|    |
|                                                                       |Control Block:   N10:0|    |
|                                                                       |Data File:        N7:0|    |
|                                                                       |LENGTH:              21|    |
|                                                                       |Continuous:           N|    |
|                                                                       +-----------------------+    |
N10:0/15 - -|/|- - File #2 MAIN_PRGRM -  2
N7:0/3 - -| |- - File #2 MAIN_PRGRM -  551
N7:0/4 - -| |- - File #2 MAIN_PRGRM -  552
N7:0/5 - -| |- - File #2 MAIN_PRGRM -  553
N7:0/6 - -| |- - File #2 MAIN_PRGRM -  554
N7:0/7 - -| |- - File #2 MAIN_PRGRM -  555
N7:0/8 - -| |- - File #2 MAIN_PRGRM -  556
N7:0/9 - -| |- - File #2 MAIN_PRGRM -  557
N7:0/10 - -| |- - File #2 MAIN_PRGRM -  558
N7:0/11 - -| |- - File #2 MAIN_PRGRM -  559
N7:0/12 - -| |- - File #2 MAIN_PRGRM -  560
N7:0/13 - -| |- - File #2 MAIN_PRGRM -  561
N7:0/14 - -| |- - File #2 MAIN_PRGRM -  562
N7:0/15 - -| |- - File #2 MAIN_PRGRM -  563
Rung #004
|                                                                       OSCILLATOR                  |
|OSCILLATOR                                                             TIMER 1                     |
|OSC                                                                    OSC_TMR1                    |
|    B3                                                                 +-TON-------------------+   |
|----|/|----------------------------------------------------------------+TIMER ON DELAY         +-(EN)-|
|    142                                                                |TIMER:          T4:184|    |
|[6]                                                                    |BASE (SEC):       0.01+-(DN) |
|                                                                       |PRESET:              50|    |
|                                                                       |ACCUM:                0|    |
|                                                                       +-----------------------+    |
T4:184.DN - -| |- - File #2 MAIN_PRGRM -  6
Rung #005
|                                                                       OSCILLATOR                  |
|OSCILLATOR                                                             TIMER 2                     |
|OSC                                                                    OSC_TMR2                    |
|    B3                                                                 +-TON-------------------+   |
|----| |----------------------------------------------------------------+TIMER ON DELAY         +-(EN)-|
|    142                                                                |TIMER:          T4:185|    |
|[6]                                                                    |BASE (SEC):       0.01+-(DN) |
|                                                                       |PRESET:              50|    |
|                                                                       |ACCUM:               48|    |
|                                                                       +-----------------------+    |
T4:185.DN - -| |- - File #2 MAIN_PRGRM -  7
Rung #006
|                                                                              OSCILLATOR  |
|OSC_THR1                                                                      OSC         |
| T4:184                                                                          B3       |
|----| |----------------------------------------------------------------------(L)--------|
|    DN                                                                           142      |
|[4]                                                                                       |
B3/142 - -| |- - File #2 MAIN_PRGRM -  5,624
```

```
        -|/|- - File #2 MAIN_PRGRM -
        -(L)- - File #2 MAIN_PRGRM -  6
        -(U)- - File #2 MAIN_PRGRM -  7
Rung #007
|                                                                          OSCILLATOR |
|OSC_TMR2                                                                  OSC        |
| T4:185                                                                       B3     |
|--| |-------------------------------------------------------------------------(U)----|
|   DN                                                                         142    |
|[5]                                                                                  |
B3/142 - -| |- - File #2 MAIN_PRGRM -  5,624
        -|/|- - File #2 MAIN_PRGRM -  4
        -(L)- - File #2 MAIN_PRGRM -  6
        -(U)- - File #2 MAIN_PRGRM -  7
Rung #008
|OSCILLATOR                                                  OSCILLATOR               |
|2                                                           TIMER 3                  |
|OSC2                                                        OSC_TMR3                 |
|    B3                                                      +-TON-----------+        |
|---|/|------------------------------------------------------|TIMER ON DELAY |-(EN)---|
|   143                                                      |TIMER:   T4:186|        |
|[10]                                                        |BASE (SEC): 0.01|-(DN)  |
|                                                            |PRESET:     200|        |
|                                                            |ACCUM:      166|        |
|                                                            +---------------+        |
T4:186.DN - -| |- - File #2 MAIN_PRGRM -  10
Rung #009
|OSCILLATOR                                                  OSCILLATOR               |
|2                                                           TIMER 4                  |
|OSC2                                                        OSC_TMR4                 |
|    B3                                                      +-TON-----------+        |
|---| |------------------------------------------------------|TIMER ON DELAY |-(EN)---|
|   143                                                      |TIMER:   T4:187|        |
|[10]                                                        |BASE (SEC): 0.01|-(DN)  |
|                                                            |PRESET:     200|        |
|                                                            |ACCUM:        0|        |
|                                                            +---------------+        |
T4:187.DN - -| |- - File #2 MAIN_PRGRM -  11
Rung #010
|                                                                          OSCILLATOR |
|                                                                          2          |
|OSC_TMR3                                                                  OSC2       |
| T4:186                                                                       B3     |
|--| |-------------------------------------------------------------------------(L)----|
|   DN                                                                         143    |
|[8]                                                                                  |
B3/143 - -| |- - File #2 MAIN_PRGRM -  9,624
        -|/|- - File #2 MAIN_PRGRM -  8
        -(L)- - File #2 MAIN_PRGRM -  10
        -(U)- - File #2 MAIN_PRGRM -  11
Rung #011
|                                                                          OSCILLATOR |
|                                                                          2          |
|OSC_TMR4                                                                  OSC2       |
| T4:187                                                                       B3     |
|--| |-------------------------------------------------------------------------(U)----|
|   DN                                                                         143    |
|[9]                                                                                  |
B3/143 - -| |- - File #2 MAIN_PRGRM -  9,624
        -|/|- - File #2 MAIN_PRGRM -  8
        -(L)- - File #2 MAIN_PRGRM -  10
        -(U)- - File #2 MAIN_PRGRM -  11
```

```
Rung #012
|                                                              MOTOR DRIVE          |
|                                                              PULSER               |
|                                                              TIMER B              |
|MDPTA                                                         MDPTB                |
|T4:298                                                        +-TON---------------+|
|--|/|--------------------------------------------------------+TIMER ON DELAY      +-(EN)-|
|  DN                                                          |TIMER:      T4:299 |      |
|[13]                                                          |BASE (SEC):   0.01 +-(DN)  |
|                                                              |PRESET:          5 |      |
|                                                              |ACCUM:           6 |      |
|                                                              +-------------------+      |
T4:299.DN - -| |- - File #2 MAIN_PRGRM -  13,14,184,189,194
Rung #013
|                                                              MOTOR DRIVE          |
|MOTOR START                                                   PULSER               |
|PULSE                                                         TIMER A              |
|MDPTB                                                         MDPTA                |
|  T4:299                                                      +-TON---------------+|
|----| |-------------------------------------------------------+TIMER ON DELAY      +-(EN)-|
|     DN                                                        |TIMER:      T4:298 |      |
|[12]                                                          |BASE (SEC):   0.01 +-(DN)  |
|                                                              |PRESET:          5 |      |
|                                                              |ACCUM:           3 |      |
|                                                              +-------------------+      |
T4:298.DN - -|/|- - File #2 MAIN_PRGRM -  12
Rung #014
|MOTOR START                                                          MOTOR DRIVE  |
|PULSE                                                                PULSER       |
|MDPTB                                                                MDP          |
|  T4:299                                                                 B3       |
|----| |-------------------------------------------------------------------( )-----|
|     DN                                                                  299       |
|[12]                                                                               |
B3/299 - -| |- - File #2 MAIN_PRGRM -  217,230,248,252,257,262,280,284,289,294,305,309,314,319,330,354
       -( )- - File #2 MAIN_PRGRM -  14
Rung #015
|               PALLET      PALLET                                                  |
|  AUTO         DETECTED    DETECTED                                   ENTER        |
|  MODE         LEFT SIDE   RIGHT SIDE                                 PRODUCTION   |
|  ENABLE       ENTRANCE    ENTRANCE                                   SYSTEM       |
|  AUTO         SEN1        SEN3                                       LLIN         |
|  N7:37        I:003       I:003                                        O:007      |
|-+--| |---+------|/|---------|/|--------------------------------------------( )----|
| |    11  |      00          02                                           15       |
| |[155]   |                                                                        |
| |MOTOR 3 |                                                                        |
| |SLOW    |                                                                        |
| |M3S     |                                                                        |
| | O:013  |                                                                        |
| +--| |---+                                                                        |
|    02                                                                             |
| [187]                                                                             |
Rung #016
|SUSPEND                                                              SUSPEND      |
|OPERATION                                                            OPERATION    |
|ENABLE                                                               LATCH        |
|SUSOPE                                                               SUSOPL       |
|  N7:18                                                                  B3       |
|----| |-------------------------------------------------------------------(L)-----|
|     0                                                                   101       |
|[3]                                                                                |
```

```
B3/101 - -|/|- - File #4 RETRN_CNVR -    ,60
         -(L)- - File #2 MAIN_PRGRM -  16
         -(U)- - File #2 MAIN_PRGRM -  17
Rung #017
|                                                                 SUSPEND    |
| PREPARE FOR                                                     OPERATION  |
| AUTO RUN                                                        LATCH      |
| >AUTO                                                           SUSOPL     |
|     N7:37                                                          B3      |
|-+----| |----+-------------------------------------------------------(U)----|
| | |     1   |                                                      101     |
| | [157]     |                                                              |
| |           | B3/101 - -|/|- - File #4 RETRN_CNVR - 59, 60                 |
| |           |          -(L)- - File #2 MAIN_PRGRM - 16                     |
| |COMPUTER   |                                                              |
| |SIGNAL FOR |                                                              |
| |AUTO MODE  |                                                              |
| |OK         |                                                              |
| |COMPAUTO   |                                                              |
| |   N7:16   |                                                              |
| +----| |----+                                                              |
|       11                                                                   |
| [3]                                                                        |
Rung #018
|PALLET
|DETECTED                                                         PALLET
|RIGHT SIDE                                                       WAITING AT |
|EXIT END                                                         MINT EXIT  |
|SEN57                                                            PWAME      |
|   I:054                                                           O:057    |
|------| |-------------------------------------------------------------( )----|
|      17                                                            14      |
Rung #019
|REGENERATE                                                       HIVAC CLOSE |
|ALL CRYO'S                                                       STAGGER     |
|TS20                                                             HVCL_STAG   |
|   N7:16                                                            B3       |
|------| |-------------------------------------------------------------(L)-----|
|      12                                                           280       |
|[3]                                                                          |
B3/280 - -| |- - File #2 MAIN_PRGRM -  20
         -(L)- - File #2 MAIN_PRGRM -  19
         -(U)- - File #2 MAIN_PRGRM -  21
Rung #020
|HIVAC CLOSE                                          HIVAC STAGGER
|STAGGER                                              TIMER
|HVCL_STAG                                            HI_STAG
|      B3                                             +-TON---------------+         |
|------| |--------------------------------------------+TIMER ON DELAY     +-(EN)-|
|     280                                             |TIMER:     T4:197  |         |
|[19]                                                 |BASE (SEC):   1.0  +-(DN)   |
|                                                     |PRESET:        35  |         |
|                                                     |ACCUM:          0  |         |
|                                                     +-------------------+         |
T4:197.ACC - GEQ - File #3 CRYO_REGEN -  34,38,42,46,52,53,57
T4:197.DN - -| |- - File #2 MAIN_PRGRM -  21
                    File #3 CRYO_REGEN -  63
```

```
Rung #021
| ABORT CRYO                                                   HIVAC CLOSE |
| REGENERATION                                                 STAGGER     |
| BT_CR                                                        HVCL_STAG   |
|     N7:17                                                        B3      |
|-+----| |----+--------------------------------------------------(U)-------|
| |     9     |                                                  280       |
| |[3]        |                                                            |
| |           | B3/280 - -| |- - File #2 MAIN_PRGRM - 20                    |
| |           |          -(L)- - File #2 MAIN_PRGRM - 19                     |
| |           |                                                            |
| |HI_STAG    |                                                            |
| | T4:197    |                                                            |
| |----| |----|                                                            |
| |    DN     |                                                            |
| |[20]       |                                                            |
| |ABORT CRYO |                                                            |
| |REGEN ENABLE                                                            |
| |ABORTCRGN  |                                                            |
| |     B3    |                                                            |
| +----| |----+                                                            |
|      297                                                                 |
| [3:26]
Rung #022
| SYSTEM IS                                         PUMPDOWN               |
| PUMPED                                            SYSTEM                 |
| DOWN                                              ENABLE                 |
| SYS_PD                                            PDSE                   |
|     B3                                                B3                 |
|-+----| |----+--------------------------------------+-+-(U)-+---------+---|
| |    389    |                                      | | 303 |         |   |
| |[140]      |                                      | |     |         |   |
| |           | B3/303 - -| |- - File #2 MAIN_PRGRM - 24, 25, 26, 27, 28, 29, 30, 31, 32,
| |           |             33, 46, 47, 48, 49, 68, 73, 78, 104, 140, 183, 200,
| |           |             216, 324, 326, 327, 353, 415
| |           |          -|/|- - File #2 MAIN_PRGRM - 369, 405, 411, 418, 425, 430
| |           |          -(L)- - File #2 MAIN_PRGRM - 23
| |           |                                      | |MANUAL         |   |
| |           |                                      | |SYSTEM         |   |
| |           |                                      | |PUMPDOWN       |   |
| |           |                                      | |ENABLE         |   |
| |           |                                      | |MSPE           |   |
| |ABORT PUMPDOWN N7:36/8 - -(L)- - File #2 MAIN_PRGRM - 23 N7:36        |   |
| |BT_PD      | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2  +-(U)-+     |   |
| |     N7:17 | T4:285.TT - -| |- - File #2 MAIN_PRGRM - 84, 91, 98  8   |   |
| |----| |----|                                      |                 |   |
| |     8     |                                      |PUMPDOWN         |   |
| |[3]        |                                      |SEQUENCE         |   |
| |           |                                      |DISABLE          |   |
| |           |                                      |PULSE            |   |
| |           |                                      |PDSDPLSE         |   |
| |PIRINI     |                                      | +-TON-------------+ |
| |GUAGE NO   |                                      +-|TIMER ON DELAY  |-(EN)-+
| |FAULT      |                                        |TIMER:    T4:285|      |
| |PGNF       |                                        |BASE (SEC):  1.0|-(DN) |
| |     B3    |                                        |PRESET:        5|      |
| |----|/|----|                                        |ACCUM:         0|      |
| |    465    |                                        +----------------+      |
| |[5:205]    |                                                              |
| |PREPARE FOR|                                                              |
| |AUTO RUN   |                                                              |
| |>AUTO      |                                                              |
| |    N7:37  |                                                              |
| +----| |----+                                                              |
|       1                                                                    |
|  [157]
```

Rung #023

```
START      PIRINI      NO CRYOS BEING  SYSTEM    VENT AREA  VENT AREA  VENT AREA  VENT AREA  VENT AREA   PUMPDOWN
PUMPDOWN   GUAGE NO    REGENERATED     VENT      1 ENABLE   2 ENABLE   3 ENABLE   4 ENABLE   5 ENABLE    SYSTEM
TS00       FAULT       NO_CYRGN        ENABLE    VENT1E     VENT2E     VENT3E     VENT4E     VENT5E      ENABLE
           PGNF                        SYSVNTE                                                           PDSE
N7:15      B3          B3              N7:37     N7:37      N7:37      N7:37      N7:37      N7:37       B3
--] [------] [---------] [-------------]/[-------]/[--------]/[--------]/[--------]/[--------]/[---------(L)--
  8        465         233             5         6          7          8          9          10          303
[3]        [5:205]     [3:33]          [368]     [405]      [411]      [418]      [425]      [430]
                                                                                                         MANUAL
                                                                                                         SYSTEM
                                                                                                         PUMPDOWN
                                                                                                         ENABLE
                                                                                                         MSPE
                                                                                                         N7:36
                                                                                                       --(L)--
                                                                                                          8
```

B3/303 -] [- File #2 MAIN_PRGRM - 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 46, 47, 48, 49, 68, 73, 78, 104, 140, 183, 200, 216, 324, 326, 327, 353, 415
]/[- File #2 MAIN_PRGRM - 369, 405, 411, 418, 425, 430
-(U)- - File #2 MAIN_PRGRM - 22
N7:36/8 - -(U)- - File #2 MAIN_PRGRM - 22
_F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2

Rung #024

```
           LLOCK      DWELL 2    DWELL 4   DWELL 5   EXLOCK
           CHAMBER    CHAMBER    CHAMBER   CHAMBER   CHAMBER
PUMPDOWN   ROUGH      ROUGH      ROUGH     ROUGH     ROUGH                  RV'S ALL
SYSTEM     VALVE      VALVE RV2  VALVE     VALVE     VALVE                  CLOSED FOR
ENABLE     CLOSED     CLOSED     CLOSED    CLOSED    CLOSED                 CROSSOVER
PDSE       RVS1       RVS3       RVS5      RVS7      RVS9                   RVS_CLOSED
B3         I:002      I:022      I:036     I:052     I:052                  B3
--] [------] [--------] [--------] [-------] [-------] [--------------------( )--
  303      15         15         15        14        16                     176
[23]
```

B3/176 -] [- File #2 MAIN_PRGRM - 105,106,107,108,109
-( )- - File #2 MAIN_PRGRM - 24

Rung #025

```
PUMPDOWN                                          PUMPDOWN
SYSTEM                                            SYSTEM
ENABLE                                            TIMER
PDSE                                              PDSTMR
B3                                                +--TON----------------+
--] [---------------------------------------------|TIMER ON DELAY       |-(EN)-
  303                                             |TIMER:       T4:190  |
[23]                                              |BASE (SEC):     1.0  |-(DN)
                                                  |PRESET:         600  |
                                                  |ACCUM:            0  |
                                                  +---------------------+
```

T4:190.DN -] [- File #2 MAIN_PRGRM - 609

Rung #026

```
PUMPDOWN                                                                    ENABLE
SYSTEM                                                                      CRYO
ENABLE                                                                      COMPRESSOR
PDSE                                                                        1
  B3                                                                        CY1
--] [--                                                                       O:010
  303                                                                       --(L)--
[23]                                                                            04
                                                                            MANUAL
          O:010/04 - -] [- - File #2 MAIN_PRGRM - 436                       CONTROL
                             File #3 CRYO_REGEN - 260                       CRYO          MANUAL CRYO
                             File #6 TECH_RUNGS - 19                        COMPRESSOR    COMPRESSOR 1
                       -(U)- - File #3 CRYO_REGEN - 6                       2 ENABLE      RUN
COOL DOWN  N7:34/5 - -(U)- - File #3 CRYO_REGEN - 6                         M-CY1-1       MCYC1RUN
1          _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                        N7:13         N7:34
CD1        N7:29/5 - -(L)- - File #3 CRYO_REGEN - 6                         --] [--------(L)--
  B3       _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                         5             5
--] [--                                                                     [3]
  651
[3:20]                                                                                    MANUAL CRYO
                                                                                          COMPRESSOR 1
            COMPRESSOR                                                                    STOP
            1 REGEN-                                                                      MCYC1STOP
PUMP AREA   ERATION                                                                         N7:29
1 ENABLE    PROGRAM                                                                       --(U)--
PUMP1E      CYRGN1                                                                            5
  N7:37       B3
--] [--------]/[--
  13          321
[434]       [3:0]
MANUAL
CONTROL
CRYO
COMPRESSOR
2 ENABLE
M-CY1-1
  N7:13
--] [--
  5
[3]
```

Rung #027

PUMPDOWN
SYSTEM
ENABLE
PDSE
B3
303
[23]

COOL DOWN
2
CD2
B3
652
[3:203]

PUMP AREA
1 ENABLE
PUMP1E
N7:37
13
[434]

COMPRESSOR
2 REGEN-
ERATION
PROGRAM
CYRGN2
B3
322
[3:34]

PUMP AREA
2 ENABLE
PUMP2E
N7:37
14
[438]

MANUAL
CONTROL
CRYO
COMPRESSOR
2 ENABLE
M-CY2-1
N7:13
6
[3]

```
0:010/05 - -| |- - File #2 MAIN_PRGRM - 436, 440
                   File #3 CRYO_REGEN - 260
                   File #6 TECH_RUNGS - 19
            -(U)- - File #3 CRYO_REGEN - 81
N7:34/6 - -(U)- - File #3 CRYO_REGEN - 81
_F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2
N7:29/6 - -(L)- - File #3 CRYO_REGEN - 81
_F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2
```

ENABLE
CRYO
COMPRESSOR
2
CY2
0:010
-(L)-
05

MANUAL
CONTROL
CRYO
COMPRESSOR
2 ENABLE
M-CY2-1
N7:13
6
[3]

MANUAL CRYO
COMPRESSOR 2
RUN
MCYC2RUN
N7:34
-(L)-
6

MANUAL CRYO
COMPRESSOR 2
STOP
MCYC2STOP
N7:29
-(U)-
6

Rung #028

```
|                                                                              ENABLE
| PUMPDOWN                                                                     CRYO
| SYSTEM                                                                       COMPRESSOR
| ENABLE                                                                       3
| PDSE                                                                         CY3
|    B3                                                                          O:030
|----] [-------------------------------------------------------------------------(L)-----
| |  303                    |                                                  |  04
| |[23]                     |                                                  |MANUAL
| |                         | O:030/04 - -] [- - File #2 MAIN_PRGRM - 440      |CONTROL
| |                         |                   File #3 CRYO_REGEN - 260       |CRYO          MANUAL CRYO
| |                         |                   File #6 TECH_RUNGS - 19        |COMPRESSOR    COMPRESSOR 3
| |                         |              -(U)- - File #3 CRYO_REGEN - 82     |3 ENABLE      RUN
| |COOL DOWN                | N7:34/7 - -(U)- - File #3 CRYO_REGEN - 82        |M-CY3-1       MCYC3RUN
| |3                        | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2      |  N7:13          N7:34
| |CD3                      | N7:29/7 - -(L)- - File #3 CRYO_REGEN - 82        |---] [-------+-----(L)-----+
| |  B3                     | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2          7         |      7    |
| |---] [-------------------|                                                  [3]           |           |
| |  653                    |                                                                |           |
| |[3:204]                  |                                                                |MANUAL CRYO|
| |                         |                                                                |COMPRESSOR 3
| |                         |                                                                |STOP       |
| |             COMPRESSOR  |                                                                |MCYC3STOP  |
| |             3 REGEN-    |                                                                |   N7:29   |
| |PUMP AREA    ERATION     |                                                                +----(U)----+
| |2 ENABLE     PROGRAM     |                                                                      7
| |PUMP2E       CYRGN3      |
| |  N7:37        B3        |
| |---] [---------]/[-------|
| |   14         323        |
| |[438]        [3:38]      |
| |MANUAL                   |
| |CONTROL                  |
| |CRYO                     |
| |COMPRESSOR               |
| |3 ENABLE                 |
| |M-CY3-1                  |
| |  N7:13                  |
| +---] [-------------------+
|      7
|  [3]
```

Rung #029

```
PUMPDOWN SYSTEM ENABLE PDSE          B3/303 [23]
COOL DOWN 4 CD4                      B3/654 [3:205]
PUMP AREA 2 ENABLE PUMP2E            N7:37/14 [438]
COMPRESSOR 4 REGENERATION PROGRAM CYRGN4   B3/324 (-|/|-) [3:42]
MANUAL CONTROL CRYO COMPRESSOR 4 ENABLE M-CY4-1   N7:13/8 [3]

O:030/05 - -| |- - File #2 MAIN_PRGRM - 440
                   File #3 CRYO_REGEN - 260
                   File #6 TECH_RUNGS - 19
           -(U)- - File #3 CRYO_REGEN - 83
N7:34/8 - -(U)- - File #3 CRYO_REGEN - 83
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2
N7:29/8 - -(L)- - File #3 CRYO_REGEN - 83
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2

ENABLE CRYO COMPRESSOR 4 CY4         O:030 -(L)- 05
MANUAL CONTROL CRYO COMPRESSOR 4 ENABLE M-CY4-1   N7:13/8 [3]
MANUAL CRYO COMPRESSOR 4 RUN MCYC4RUN     N7:34 -(L)- 8
MANUAL CRYO COMPRESSOR 4 STOP MCYC4STOP   N7:29 -(U)- 8
```

Rung #030

```
PUMPDOWN                                                                          ENABLE
SYSTEM                                                                            CRYO
ENABLE                                                                            COMPRESSOR
PDSE                                                                              5
  B3                                                                              CY5
                                                                                    O:044
--| |----+------------------------------------------------------------------------+--(L)--
   303   |                                                                        |   04
[23]     | O:044/04 - -| |- - File #2 MAIN_PRGRM - 440, 444                       |MANUAL
         |                    File #3 CRYO_REGEN - 260                            |CONTROL
         |                    File #6 TECH_RUNGS - 19                             |CRYO          MANUAL CRYO
         |            -(U)- - File #3 CRYO_REGEN - 84                             |COMPRESSOR    COMPRESSOR 5
COOL DOWN| N7:34/9 - -(U)- - File #3 CRYO_REGEN - 84                              |5 ENABLE      RUN
5        | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                            |M-CY5-1       MCYC5RUN
CD5      | N7:29/9 - -(L)- - File #3 CRYO_REGEN - 84                              |  N7:13         N7:34
  B3     | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                            +--| |---+-------(L)----
--| |----+                                                                            9   |         9
  655    |                                                                        [3]     |
[3:206]  |                                                                                |MANUAL CRYO
         |                                                                                |COMPRESSOR 5
                   COMPRESSOR                                                             |STOP
                   5 REGEN-                                                               |MCYC5STOP
  PUMP AREA        ERATION                                                                |   N7:29
  2 ENABLE         PROGRAM                                                                +---(U)----
  PUMP2E           CYRGN5                                                                      9
    N7:37            B3
--+--| |----+------|/|----
  |    14   |      325
  |[438]    |     [3:46]
  |PUMP AREA|
  |3 ENABLE |
  |PUMP3E   |
  |  N7:37  |
  +--| |----+
      15
  [442]
MANUAL
CONTROL
CRYO
COMPRESSOR
5 ENABLE
M-CY5-1
   N7:13
--| |----+
     9
 [3]
```

Rung #031

PUMPDOWN SYSTEM ENABLE POSE
B3
303
[23]

COOL DOWN 6 CD6
B3
656
[3:207]

PUMP AREA 3 ENABLE PUMP3E
N7:37
15
[442]

COMPRESSOR 6 REGEN-ERATION PROGRAM CYRGN6
B3 -|/|-
326
[3:52]

MANUAL CONTROL CRYO COMPRESSOR 6 ENABLE M-CY6-1
N7:13
10
[3]

```
O:044/05 - -| |- - File #2 MAIN_PRGRM - 444
                   File #3 CRYO_REGEN - 260
                   File #6 TECH_RUNGS - 19
           -(U)- - File #3 CRYO_REGEN - 85
N7:34/10 - -(U)- - File #3 CRYO_REGEN - 85
_F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2
N7:29/10 - -(L)- - File #3 CRYO_REGEN - 85
_F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2
```

ENABLE CRYO COMPRESSOR 6 CY6
O:044
-(L)-
05

MANUAL CONTROL CRYO COMPRESSOR 6 ENABLE M-CY6-1
N7:13
10
[3]

MANUAL CRYO COMPRESSOR 6 RUN MCYC6RUN
N7:34
-(L)-
10

MANUAL CRYO COMPRESSOR 6 STOP MCYC6STOP
N7:29
-(U)-
10

```
Rung #032
|                                                                                          ENABLE
|  PUMPDOWN                                                                                CRYO
|  SYSTEM                                                                                  COMPRESSOR
|  ENABLE                                                                                  7
|  PDSE                                                                                    CY7
|     B3                                                                                     O:060
|-+---| |----+-----------------------------------------------------------------------------+---(L)---+-|
| |   303      |                                                                           |    04     | |
| |[23]        |                                                                           |MANUAL     | |
| |            |O:060/04 - -| |- - File #2 MAIN_PRGRM - 449, 453                          |CONTROL    | |
| |            |                  File #3 CRYO_REGEN - 260                                 |CRYO       MANUAL CRYO   | |
| |            |                  File #6 TECH_RUNGS - 19                                  |COMPRESSOR COMPRESSOR 7 | |
| |            |             -(U)- - File #3 CRYO_REGEN - 86                               |7 ENABLE   RUN         | |
| |COOL DOWN   |N7:34/11 - -(U)- - File #3 CRYO_REGEN - 86                                 |M-CY7-1    MCYC7RUN    | |
| |7           |_F:N7:21 &21 - BTW - File #2 MAIN_PRGRM - 2                                |  N7:13      N7:34     | |
| |CD7         |N7:29/11 - -(L)- - File #3 CRYO_REGEN - 86                                 +---| |---+---(L)---+ |
| |   B3       |_F:N7:21 &21 - BTW - File #2 MAIN_PRGRM - 2                                    11    |    11   |   |
| +---| |------+                                                                          [3]      |         |   |
| |   657      |                                                                                   |MANUAL CRYO  |
| |[3:208]     |                                                                                   |COMPRESSOR 7 |
| |            |                                                                                   |STOP         |
| |            |                                                                                   |MCYC7STOP    |
| |              COMPRESSOR |                                                                      |   N7:29     |
| |              7 REGEN-   |                                                                      +---(U)-------+
| |  PUMP AREA   ERATION    |                                                                          11
| |  4 ENABLE    PROGRAM    |
| |  PUMP4E      CYRGN7     |
| |    N7:38        B3      |
| +-+---| |---+-----|/|-----+
| | |    0    |    327      |
| | |[447]    |  [3:57]     |
| | |PUMP AREA|             |
| | |5 ENABLE |             |
| | |PUMP5E   |             |
| | |  N7:38  |             |
| | +---| |---+             |
| |      1                  |
| |  [451]                  |
| |MANUAL                   |
| |CONTROL                  |
| |CRYO                     |
| |COMPRESSOR               |
| |7 ENABLE                 |
| |M-CY7-1                  |
| |  N7:13                  |
| +---| |-------------------+
|     11
|  [3]
```

Rung #033

```
                                                                                          ENABLE
 PUMPDOWN                                                                                 CRYO
 SYSTEM                                                                                   COMPRESSOR
 ENABLE                                                                                   8
 PDSE                                                                                     CY8
    B3                                                                                      O:060
---] [----+------------------------------------------------------------------------------+---(L)----
    303                                                                                  |   05
 [23]                                                                                    |MANUAL
          | O:060/05 - ] [ - File #2 MAIN_PRGRM - 449                                    |CONTROL
          |                  File #3 CRYO_REGEN - 260                                    |CRYO        MANUAL CRYO
          |                  File #6 TECH_RUNGS - 19                                     |COMPRESSOR  COMPRESSOR 8
          |             -(U)- - File #3 CRYO_REGEN - 87                                  |8 ENABLE    RUN
 COOL DOWN| N7:34/12 - -(U)- - File #3 CRYO_REGEN - 87                                   |M-CY8-1     MCYC8RUN
 8        | _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2                                  |  N7:13      N7:34
 CD8      | N7:29/12 - -(L)- - File #3 CRYO_REGEN - 87                                   +---] [----+----(L)----
    B3    | _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2                                      12     |    12
---] [----+                                                                              [3]        |
    658                                                                                             |MANUAL CRYO
 [3:209]                                                                                            |COMPRESSOR 8
                COMPRESSOR                                                                          |STOP
                8 REGEN-                                                                            |MCYC8STOP
 PUMP AREA      ERATION                                                                             |   N7:29
 4 ENABLE       PROGRAM                                                                             +----(U)----
 PUMP4E         CYRGN8                                                                                   12
   N7:38          B3
---] [----------]/[---+
    0            328
 [447]          [3:63]
 MANUAL
 CONTROL
 CRYO
 COMPRESSOR
 8 ENABLE
 M-CY8-1
   N7:13
---] [----------------+
    12
 [3]
```

Rung #034

```
| MANUAL                                                      OPEN RGA
| CONTROL                                                     ISOLATION
| RGA VALVE                                                   VALVE 1
| 1 CLOSE                                                     RGAV1
| M-RGAV1-0                                                     O:010
|   N7:9
|---] [------------------------------------------------------+---(U)---+
|     1                                                      |    13   |
| [3]                                                        |         |
|           O:010/13 - ] [ - File #6 TECH_RUNGS - 7          |         |
|                      -(L)- - File #2 MAIN_PRGRM - 371      |MANUAL RGA
|           N7:28/5 - -(L)- - File #2 MAIN_PRGRM - 371       |VALVE 1  |
|           _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2      |OPEN     |
| VENT AREA N7:30/1 - -(U)- - File #2 MAIN_PRGRM - 371       |MRGAV1OP |
| 1 ENABLE  _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2      |   N7:28 |
| VENT1E                                                     +---(U)---+
|   N7:37                                                    |    5    |
|---] [---                                                   |         |
|     6                                                      |MANUAL RGA
| [405]                                                      |VALVE 1  |
|                                                            |CLOSE    |
|                                                            |MRGAV1CL |
| SYSTEM                                                     |   N7:30 |
| VENT                                                       +---(L)---+
| ENABLE                                                          1
| SYSVNTE
|   N7:37
|---] [---
|     5
| [368]
| HEATER 1
| CHAMBER
| =<250
| MICRONS
| PIR2
|   I:004
|---]/[---
|    10
```

```
Rung #035
| MANUAL                                                                                         |
| CONTROL                                                                        OPEN RGA        |
| RGA VALVE                                                                      ISOLATION       |
| 2 CLOSE                                                                        VALVE 2         |
| M-RGAV2-0                                                                      RGAV2           |
|    N7:9                                                                          O:030         |
|-+----] [---+-----------------------------------------------------------------+----(U)---------+
| |     2    |                                                                 |     13         |
| |[3]       |                                                                 |                |
| |          | O:030/13 - ] [ - File #6 TECH_RUNGS - 7                         |                |
| |          |          -(L)- - File #2 MAIN_PRGRM - 372                       |MANUAL RGA      |
| |          | N7:28/6 - -(L)- - File #2 MAIN_PRGRM - 372                      |VALVE 2         |
| |          | _F:N7:21L%21 - BTW - File #2 MAIN_PRGRM - 2                     |OPEN            |
| |VENT AREA | N7:30/2 - -(U)- - File #2 MAIN_PRGRM - 372                      |MRGAV2OP        |
| |2 ENABLE  | _F:N7:21L%21 - BTW - File #2 MAIN_PRGRM - 2                     |   N7:28        |
| |VENT2E    |                                                                 +----(U)---------+
| |   N7:37  |                                                                 |     6          |
| +---] [----+                                                                 |                |
| |     7    |                                                                 |                |
| |[411]     |                                                                 |MANUAL RGA      |
| |          |                                                                 |VALVE 2 CLOSE   |
| |          |                                                                 |MRGAV2CL        |
| |SYSTEM    |                                                                 |   N7:30        |
| |VENT      |                                                                 +----(L)---------+
| |ENABLE    |                                                                       2          |
| |SYSVNTE   |                                                                                  |
| |  N7:37   |                                                                                  |
| +---] [----+                                                                                  |
| |    5     |                                                                                  |
| |[368]     |                                                                                  |
| |CHROME    |                                                                                  |
| |CHAMBER   |                                                                                  |
| |=<250     |                                                                                  |
| |MICRONS   |                                                                                  |
| |PIR6      |                                                                                  |
| |  I:024   |                                                                                  |
| +---]/[----+                                                                                  |
|     07                                                                                         |
```

Rung #036

```
| SYSTEM                                                                     OPEN RGA        |
| VENT                                                                       ISOLATION       |
| ENABLE                                                                     VALVE 3         |
| SYSVNTE                                                                    RGAV3           |
|  N7:37                                                                       O:044         |
|--+--| |--+-------------------------------------------------------------+------(U)-------+
|  |   5   |                                                             |       13       |
|  |[368]  |                                                             |                |
|  |       | O:044/13 - -| |- - File #6 TECH_RUNGS - 7                  |                |
|  |       |          -(L)- - File #2 MAIN_PRGRM - 373                  |MANUAL RGA      |
|  |       | N7:28/7 - -(L)- - File #2 MAIN_PRGRM - 373                 |VALVE 3         |
|  |       | _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2                |OPEN            |
|  |VENT AREA | N7:30/3 - -(U)- - File #2 MAIN_PRGRM - 373              |MRGAV3OP        |
|  |3 ENABLE | _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2              |   N7:28        |
|  |VENT3E   |                                                           +------(U)-------+
|  |  N7:37  |                                                           |      7         |
|  +--| |----+                                                           |                |
|  |   8     |                                                           |                |
|  |[418]    |                                                           |MANUAL RGA      |
|  |         |                                                           |VALVE 3 CLOSE   |
|  |MANUAL   |                                                           |MRGAV3CL        |
|  |CONTROL  |                                                           |    N7:30       |
|  |RGA VALVE|                                                           +------(L)-------+
|  |3 CLOSE  |                                                                   3          |
|  |M-RGAV3-0|                                                                              |
|  |  N7:9   |                                                                              |
|  +--| |----+                                                                              |
|  |   3     |                                                                              |
|  |[3]      |                                                                              |
|  |MAGNETIC |                                                                              |
|  |CHAMBER  |                                                                              |
|  |=<250    |                                                                              |
|  |MICRONS  |                                                                              |
|  |PIR11    |                                                                              |
|  |  I:040  |                                                                              |
|  +--|/|----+                                                                              |
|     07                                                                                     |
```

```
Rung #037
| MANUAL                                                                        OPEN RGA        |
| CONTROL                                                                       ISOLATION       |
| RGA VALVE                                                                     VALVE 4         |
| 4 CLOSE                                                                       RGAV4           |
| M-RGAV4-O                                                                        O:060        |
|    N7:9                                                                                       |
|----| |--+------------------------------------------------------------------------+---(U)------|
|  |  4   |                                                                        |   13       |
|  | [3]  |                                                                        |            |
|  |      | O:060/13 - -| |- - File #6 TECH_RUNGS - 7                             |            |
|  |      |            -(L)- - File #2 MAIN_PRGRM - 374                            |MANUAL RGA  |
|  |      | N7:28/8 - -(L)- - File #2 MAIN_PRGRM - 374                             |VALVE 4     |
|  |SYSTEM| _F:N7:21(X21 - BTW - File #2 MAIN_PRGRM - 2                           |OPEN        |
|  |VENT  | N7:30/4 - -(U)- - File #2 MAIN_PRGRM - 374                             |MRGAV4OP    |
|  |ENABLE| _F:N7:21(X21 - BTW - File #2 MAIN_PRGRM - 2                           |   N7:28    |
|  |SYSVNTE                                                                      |            |
|  |  N7:37 |                                                                      +---(U)------|
|  +--| |--+                                                                      |    8       |
|  |   5    |                                                                      |            |
|  | [368]  |                                                                      |MANUAL RGA  |
|  |        |                                                                      |VALVE 4 CLOSE
|  |        |                                                                      |MRGAV4CL    |
|  |VENT AREA                                                                      |   N7:30    |
|  |4 ENABLE|                                                                      +---(L)------|
|  |VENT4E  |                                                                          4        |
|  |  N7:37 |                                                                                   |
|  +--| |--+                                                                                   |
|  |   9    |                                                                                   |
|  |[425]   |                                                                                   |
|  |CARBON  |                                                                                   |
|  |CHAMBER |                                                                                   |
|  |=<250   |                                                                                   |
|  |MICRONS |                                                                                   |
|  |PIR16   |                                                                                   |
|  |  I:054 |                                                                                   |
|  +--|/|--+                                                                                    |
|     07                                                                                        |
```

Rung #038

MANUAL CONTROL GAS FLOW VALVE 1 CLOSE
M-GF1-0
N7:9
7
[3]

OPEN GAS FLOW ISOLATION VALVE 1
GF1
O:010
(U)
07

O:010/07 - -(L)- - File #2 MAIN_PRGRM - 379
N7:30/15 - -(L)- - File #2 MAIN_PRGRM - 379
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2
N7:30/7 - -(U)- - File #2 MAIN_PRGRM - 379
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2

AUTO OFF PULSE
AUOFPULSE
T4:283
TT
[155]

MANUAL GAS FLOW I V 1 OPEN
MGFIV1OP
N7:30
(U)
15

MANUAL GAS FLOW I V 1 CLOSE
MGFIV1CL
N7:30
(L)
7

HEATER 1 HIVAC BAFFLE
HV1_2
O:011
/
12
[116]

Rung #039

MANUAL CONTROL GAS FLOW VALVE 2 CLOSE
M-GF2-0
N7:9
8
[3]

OPEN GAS FLOW ISOLATION VALVE 2
GF2
O:010
(U)
10

O:010/10 - -(L)- - File #2 MAIN_PRGRM - 380
N7:31/0 - -(L)- - File #2 MAIN_PRGRM - 380
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2
N7:30/8 - -(U)- - File #2 MAIN_PRGRM - 380
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2

AUTO OFF PULSE
AUOFPULSE
T4:283
TT
[155]

MANUAL GAS FLOW I V 2 OPEN
MGFIV2OP
N7:31
(U)
0

MANUAL GAS FLOW I V 2 CLOSE
MGFIV2CL
N7:30
(L)
8

```
BASE :   Rung #040
| MANUAL
| CONTROL                                                          OPEN
| GAS FLOW                                                         GAS FLOW
| VALVE 3                                                          ISOLATION
| CLOSE                                                            VALVE 3
| M-GF3-0                                                          GF3
|    N7:9                                                            O:030
|-+---] [---+-------------------------------------------------------+----(U)----
| |    9    |                                                       |     07
| |[3]      |                                                       |
| |         | O:030/07 - -] [- - File #2 MAIN_PRGRM - 156           |
| |         |           -(L)- - File #2 MAIN_PRGRM - 381            |MANUAL GAS
| |         | N7:31/1 - -(L)- - File #2 MAIN_PRGRM - 381            |FLOW I V 3
| |         | _F:N7:21‡21 - BTW - File #2 MAIN_PRGRM - 2            |OPEN
| |AUTO OFF | N7:30/9 - -(U)- - File #2 MAIN_PRGRM - 381            |MGFIV3OP
| |PULSE    | _F:N7:21‡21 - BTW - File #2 MAIN_PRGRM - 2            |  N7:31
| |AUOFPULSE|                                                       +----(U)----
| |  T4:283 |                                                       |     1
| +---] [---+                                                       |
|      TT                                                           |
|  [155]                                                            |MANUAL GAS
|                                                                   |FLOW I V 3
|                                                                   |CLOSE
                                                                    |MGFIV3CL
                                                                    |  N7:30
                                                                    +----(L)----
                                                                          9
```

```
Rung #041
| MANUAL
| CONTROL                                                                          OPEN
| GAS FLOW                                                                         GAS FLOW
| VALVE 4                                                                          ISOLATION
| CLOSE                                                                            VALVE 4
| M-GM4-O                                                                          GF4
|   N7:9                                                                             O:030
|---] [----------------------------------------------------------------------------+---(U)---+
| |  10  |                                                                         |   10     |
| |[3]   |                                                                         |          |
| |      | O:030/10 - -(L)- - File #2 MAIN_PRGRM - 382                              |          |
| |      | N7:31/2 - -(L)- - File #2 MAIN_PRGRM - 382                               |MANUAL GAS|
| |      | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                              |FLOW I V 4|
| |      | N7:30/10 - -(U)- - File #2 MAIN_PRGRM - 382                              |OPEN      |
| |AUTO OFF| _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                            |MGFIV4OP  |
| |PULSE   |                                                                       |  N7:31   |
| |AUOFPULSE|                                                                      +---(U)----+
| | T4:283 |                                                                         |   2      |
| +---] [--+                                                                       |          |
|      TT                                                                          |          |
|  [155]                                                                           |MANUAL GAS|
|                                                                                  |FLOW I V 4|
|                                                                                  |CLOSE     |
|                                                                                  |MGFIV4CL  |
|                                                                                  |  N7:30   |
|                                                                                  +---(L)----+
|                                                                                      10
```

BASE : Rung #042

```
| MANUAL                                                                          |
| CONTROL                                                                         |
| GAS FLOW                                                          GAS FLOW      |
| VALVE 5                                                           ISOLATION     |
| CLOSE                                                             VALVE 5       |
| M-GF5-0                                                           GF5           |
|   N7:9                                                              O:044       |
|-+---] [--+------------------------------------------------------+----(U)----+-|
| |   11   :                                                      |    07     | |
| | [3]    :                                                      |           | |
| |        | O:044/07 - ] [ - File #2 MAIN_PRGRM - 156            |           | |
| |        |          -(L)- - File #2 MAIN_PRGRM - 383            |MANUAL GAS | |
| |        | N7:31/3 - -(L)- - File #2 MAIN_PRGRM - 383           |FLOW I V 5 | |
| |        | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2          |OPEN       | |
| |AUTO OFF| N7:30/11 - -(U)- - File #2 MAIN_PRGRM - 383          |MGFIV5OP   | |
| |PULSE   | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2          |   N7:31   | |
| |AUOFPULSE|                                                     +----(U)----+ |
| | T4:283 |                                                      |     3     | |
| +---] [--+                                                      |           | |
|     TT                                                          |           | |
|  [155]                                                          |MANUAL GAS | |
|                                                                 |FLOW I V 5 | |
|                                                                 |CLOSE      | |
|                                                                 |MGFIV5CL   | |
|                                                                 |   N7:30   | |
|                                                                 +----(L)----+ |
|                                                                       11        |
```

Rung #043

```
| MANUAL                                                                       GAS FLOW
| CONTROL                                                                      ISOLATION
| GAS FLOW                                                                     VALVE 6
| VALVE 6                                                                      GF6
| CLOSE                                                                           O:044
| M-GF6-O                                                                  |-----(U)-----|
|    N7:9                                                                  |      10     |
|---] [---------------------------------------------------------------------|             |
| |   12     |                                                             |MANUAL GAS   |
| |[3]       | O:044/10 - -(L)- - File #2 MAIN_PRGRM - 384                 |FLOW I V 6   |
| |          | N7:31/4 - -(L)- - File #2 MAIN_PRGRM - 384                  |OPEN         |
| |          | _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2                 |MGFIV6OP     |
| |SYSTEM    | N7:30/12 - -(U)- - File #2 MAIN_PRGRM - 384                 |   N7:31     |
| |VENT      | _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2                 |-----(U)-----|
| |ENABLE    |                                                             |      4      |
| |SYSVNTE   |                                                             |             |
| |  N7:37   |                                                             |MANUAL GAS   |
| |---] [----|                                                             |FLOW I V 6   |
| |    5     |                                                             |CLOSE        |
| |[368]     |                                                             |MGFIV6CL     |
| |          |                                                             |   N7:30     |
| |          |                                                             |-----(L)-----|
| |VENT AREA |                                                                   12
| |3 ENABLE  |
| |VENT3E    |
| |  N7:37   |
| |---] [----|
|      8
|  [418]
```

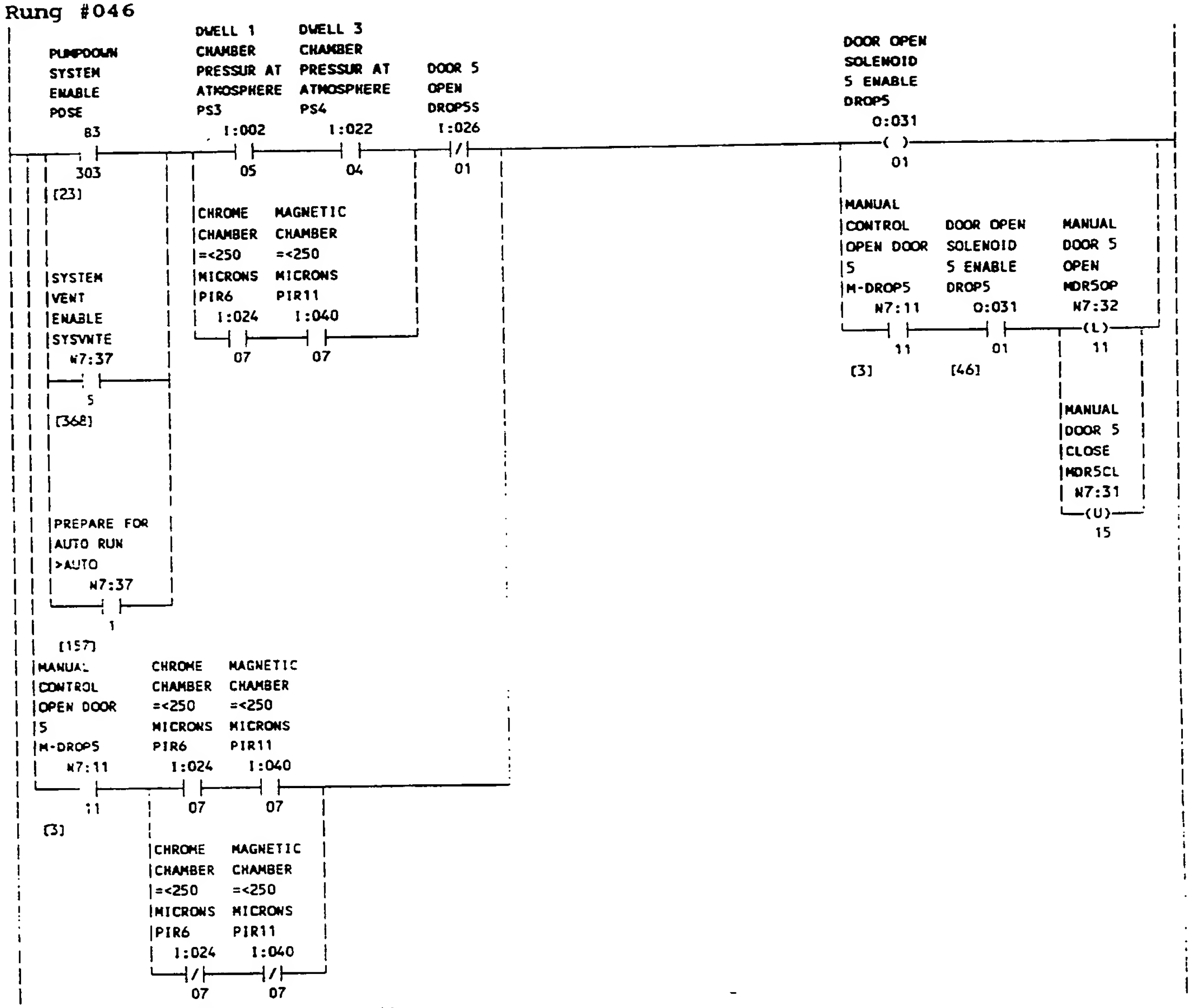
BASE : Rung #044

```
| MANUAL
| CONTROL
| GAS FLOW                                                        GAS FLOW
| VALVE 7                                                         ISOLATION
| CLOSE                                                           VALVE 7
| M-GF7-0                                                         GF7
|    N7:9                                                           O:060
+--+--] [--+------------------------------------------------------+--(U)--+
|  |   13  |                                                      |   07
|  |[3]    |
|  |       | O:060/07 - ] [ - - File #2 MAIN_PRGRM - 156           |
|  |       |          -(L)- - File #2 MAIN_PRGRM - 385             |MANUAL GAS
|  |       | N7:31/5 - -(L)- - File #2 MAIN_PRGRM - 385            |FLOW I V 7
|  |       | _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2           |OPEN
|  |AUTO OFF | N7:30/13 - -(U)- - File #2 MAIN_PRGRM - 385         |MGFIV7OP
|  |PULSE    | _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2         |  N7:31
|  |AUOFPULSE|                                                     +--(U)--+
|  | T4:283  |                                                     |   5
|  +--] [----+                                                     |
|      TT                                                          |MANUAL GAS
|  [155]                                                           |FLOW I V 7
|                                                                  |CLOSE
|                                                                  |MGFIV7CL
|                                                                  |  N7:30
|                                                                  +--(L)--
                                                                       13
```

BASE : Rung #045

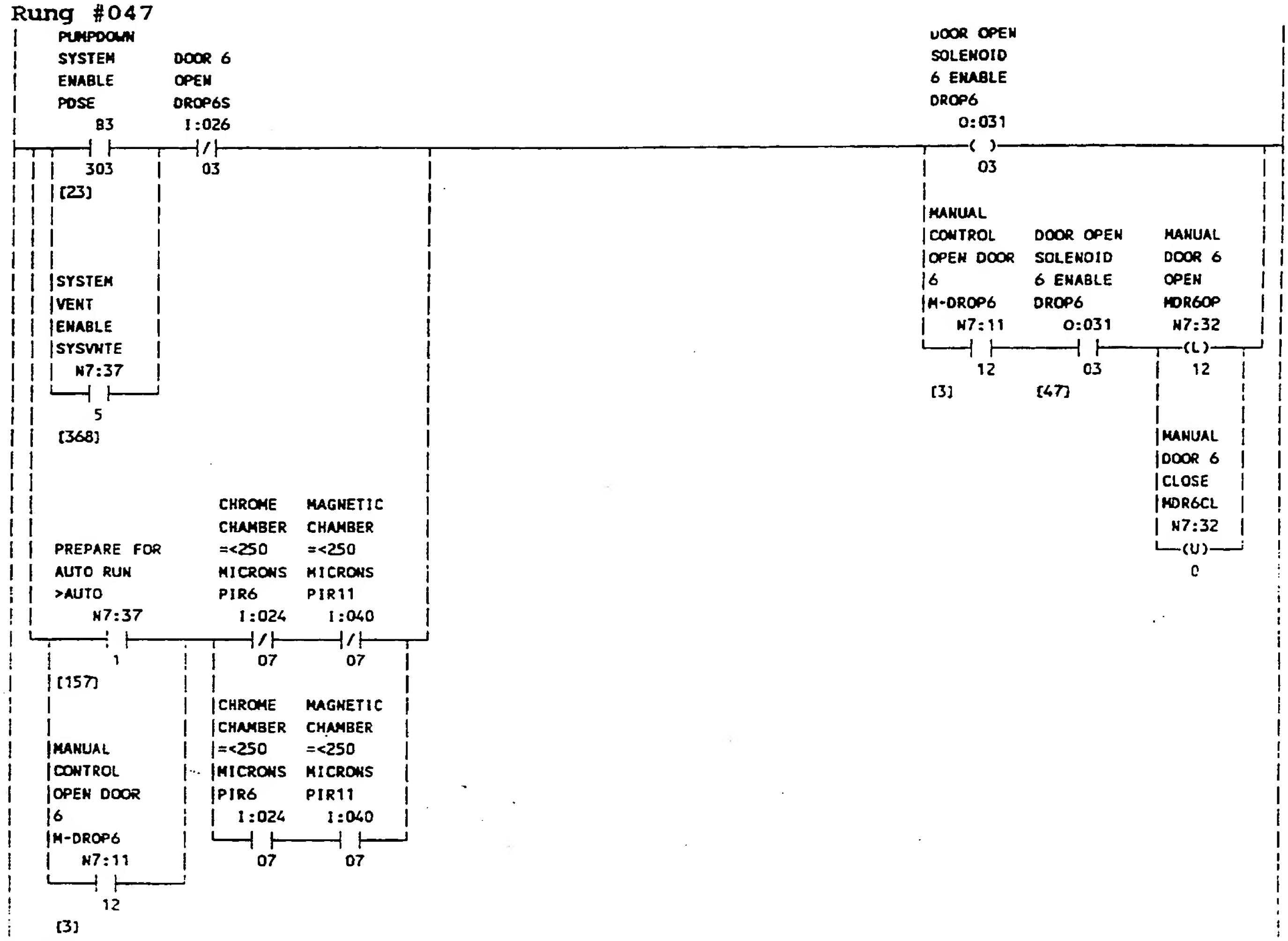
```
| MANUAL
| CONTROL                                                          GAS FLOW
| GAS FLOW                                                         ISOLATION
| VALVE 8                                                          VALVE 8
| CLOSE                                                            GF8
| M-GF8-0                                                             O:060
|    N7:9
|-+---] [----+----------------------------------------------------+----(U)----+-
| |    14    |                                                    |     10    |
| |[3]       |                                                    |           |
| |          | O:060/10 - -(L)- - File #2 MAIN_PRGRM - 386        |           |
| |          | N7:31/6 - -(L)- - File #2 MAIN_PRGRM - 386         |MANUAL GAS |
| |          | _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2        |FLOW I V 8 |
| |          | N7:30/14 - -(U)- - File #2 MAIN_PRGRM - 386        |OPEN       |
| |AUTO OFF  | _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2        |MGFIV8OP   |
| |PULSE     |                                                    |   N7:31   |
| |AUOFPULSE |                                                    +----(U)----+
| |  T4:283  |                                                    |     6     |
| +---] [----+                                                    |           |
|      TT                                                         |           |
| [155]                                                           |MANUAL GAS |
|                                                                 |FLOW I V 8 |
|                                                                 |CLOSE      |
|                                                                 |MGFIV8CL   |
|                                                                 |   N7:30   |
|                                                                 +----(L)----+
|                                                                       14
```

Rung #046



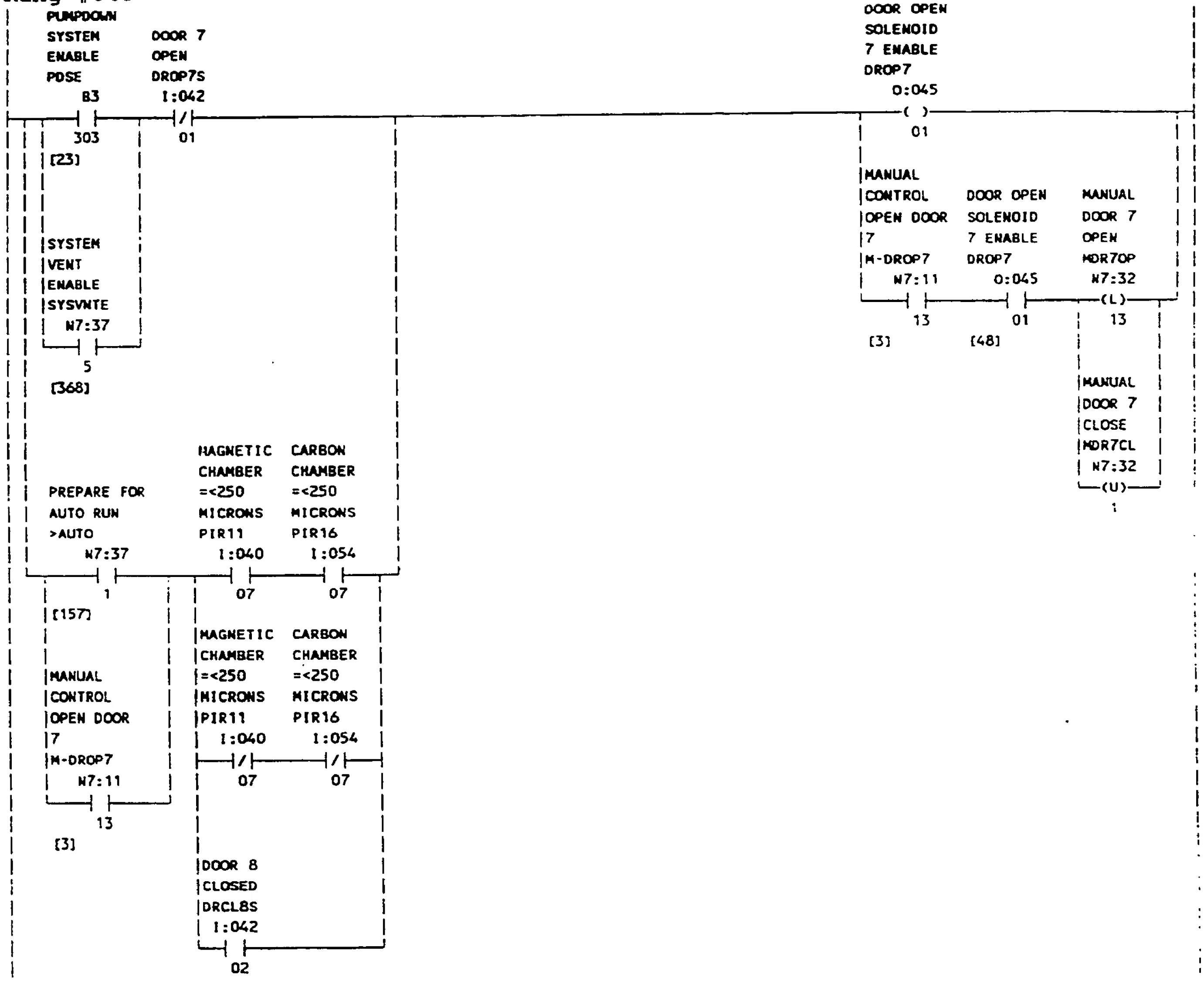

```
O:031/01 - -| |- - File #2 MAIN_PRGRM -  46
                   File #5 FAULTS -  49
                   File #6 TECH_RUNGS -  2
           -( )- - File #2 MAIN_PRGRM -  46
N7:32/11 - -(L)- - File #2 MAIN_PRGRM -  46
           -(U)- - File #2 MAIN_PRGRM -  414
_F:N7:211X21 - BTW - File #2 MAIN_PRGRM -  2
N7:31/15 - -(L)- - File #2 MAIN_PRGRM -  414
           -(U)- - File #2 MAIN_PRGRM -  46
_F:N7:211X21 - BTW - File #2 MAIN_PRGRM -  2
```

Rung #047



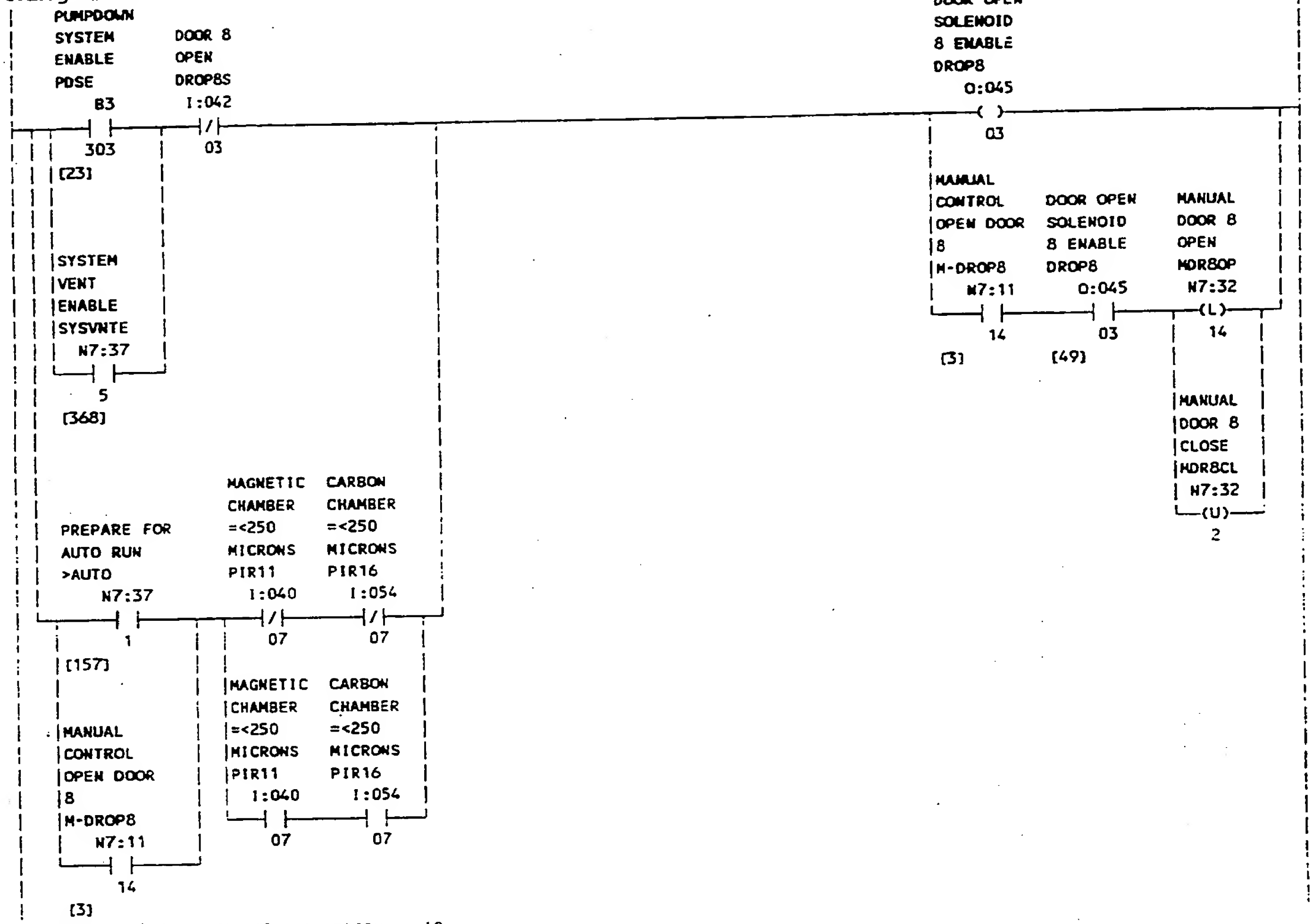

```
O:031/03 - -] [- - File #2 MAIN_PRGRM -  47
                   File #5 FAULTS -  51
                   File #6 TECH_RUNGS -  2
         -( )- - File #2 MAIN_PRGRM -  47
N7:32/12 - -(L)- - File #2 MAIN_PRGRM -  47
         -(U)- - File #2 MAIN_PRGRM -  420
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM -  2
N7:32/0 - -(L)- - File #2 MAIN_PRGRM -  420
        -(U)- - File #2 MAIN_PRGRM -  47
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM -  2
```

Rung #048




```
O:045/01 - -| |- - File #2 MAIN_PRGRM -  48
                   File #5 FAULTS -  53
                   File #6 TECH_RUNGS -  3
            -( )- - File #2 MAIN_PRGRM -  48
N7:32/13 - -(L)- - File #2 MAIN_PRGRM -  48
            -(U)- - File #2 MAIN_PRGRM -  422
_F:N7:21%21 - BTW - File #2 MAIN_PRGRM -  2
N7:32/1 - -(L)- - File #2 MAIN_PRGRM -  422
          -(U)- - File #2 MAIN_PRGRM -  48
_F:N7:21%21 - BTW - File #2 MAIN_PRGRM -  2
```

Rung #049




```
O:045/03 - -| |- - File #2 MAIN_PRGRM -  49
                   File #5 FAULTS -  55
                   File #6 TECH_RUNGS -  3
            -( )- - File #2 MAIN_PRGRM -  49
N7:32/14 - -(L)- - File #2 MAIN_PRGRM -  49
            -(U)- - File #2 MAIN_PRGRM -  427
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM -  2
N7:32/2 - -(L)- - File #2 MAIN_PRGRM -  427
           -(U)- - File #2 MAIN_PRGRM -  49
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM -  2
```

Rung #050

```
|DWELL 1                                                                      |
|CHAMBER                                                                      |
|PRESSUR AT                                          CHAMBER VENT 2           |
|ATMOSPHERE                                          CLOSE DELAY              |
|PS3                                                 CV2_DLY                  |
|   I:002                                            +-TON-----------+        |
|----] [---------------------------------------------+TIMER ON DELAY +-(EN)---|
|    05                                              |TIMER:   T4:318|        |
|                                                    |BASE (SEC): 1.0+-(DN)   |
| T4:318.DN - ] [ - File #2 MAIN_PRGRM - 51          |PRESET:       2|        |
|                                                    |ACCUM:        0|        |
|                                                    +---------------+        |
```

Rung #051

```
|                                                                              OPEN         |
|                                                                              DWELL 2      |
|                                                                              VENT VALVE   |
| CV2_DLY                                                                      CV2          |
|  T4:318                                                                         O:007     |
|-+--] [--+-----------------------------------------------------------------------(U)-------|
| |   DN  |                                                                        17       |
| |[50]   |                                                                                 |
| |       | O:007/17 - ] [ - File #5 FAULTS - 144                                           |
| |MANUAL |                  File #6 TECH_RUNGS - 0                                         |
| |CONTROL|            ]/[ - File #2 MAIN_PRGRM - 368                                       |
| |CHAMBER|                  File #5 FAULTS - 146                                           |
| |VENT VALVE         -(L)- - File #2 MAIN_PRGRM - 396                                      |
| |CLOSE  |                                                                                 |
| |M-CV2-0|                                                                                 |
| |  N7:4 |                                                                                 |
| |--] [--|                                                                                 |
| |   1   |                                                                                 |
| |[3]    |                                                                                 |
| |HEATER 2                                                                                 |
| |CHAMBER                                                                                  |
| |GATE VALVE   DOOR 4                                                                      |
| |CLOSE        CLOSED                                                                      |
| |HV2S1        DRCL4S                                                                      |
| |  I:004      I:006                                                                       |
| |--]/[--------]/[--|                                                                      |
| |   00        06                                                                          |
| |DWELL 1                                                                                  |
| |CHAMBER                                                                                  |
| |GATE VALVE                                                                               |
| |CLOSED                                                                                   |
| |HV3S1                                                                                    |
| |  I:004                                                                                  |
| |--]/[--|                                                                                 |
| |   03                                                                                    |
| |DWELL 2                                                                                  |
| |CHAMBER                                                                                  |
| |GATE VALVE                                                                               |
| |CLOSED                                                                                   |
| |HV4S1                                                                                    |
| |  I:022                                                                                  |
| |--]/[--|                                                                                 |
| |   06                                                                                    |
| |HEATER 3                                                                                 |
| |CHAMBER                                                                                  |
| |GATE VALVE                                                                               |
| |CLOSED                                                                                   |
| |HV5S1                                                                                    |
| |  I:024                                                                                  |
| |--]/[--|                                                                                 |
| |   00                                                                                    |
| |ABORT SYSTEM                                                                             |
| |VENT                                                                                     |
| |BORT_SYS_VNT                                                                             |
| |  N7:17                                                                                  |
| +--] [--+                                                                                 |
|     10                                                                                    |
|  [3]                                                                                      |
```

Rung #052

```
|DWELL 3                                                                          |
|CHAMBER                                                                          |
|PRESSUR AT                                                      CHAMBER VENT 3   |
|ATMOSPHERE                                                      CLOSE DELAY      |
|PS4                                                             CV3_DLY          |
|   I:022                                                        +--TON---------+ |
|----] [----------------------------------------------------------|TIMER ON DELAY |-(EN)-|
|    04                                                          |TIMER:  T4:319| |
|                                                                |BASE (SEC): 1.0|-(DN) |
| T4:319.DN - ] [ - File #2 MAIN_PRGRM - 53                      |PRESET:      2| |
|                                                                |ACCUM:       0| |
|                                                                +--------------+ |
```

```
Rung #053                                                              OPEN
                                                                       DWELL 3
                                                                       VENT VALVE
                                                                       CV3
 CV3_DLY                                                                 O:027
  T4:319                                                               --(U)--
---| |----------------------------------------------------------------    16
    DN
 [52]
                 O:027/16 - -| |- - File #5 FAULTS - 148
 MANUAL                             File #6 TECH_RUNGS - 0
 CONTROL                   -|/|- - File #2 MAIN_PRGRM - 368
 CHAMBER                            File #5 FAULTS - 150
 VENT VALVE                -(L)- - File #2 MAIN_PRGRM - 401
 CLOSE
 M-CV3-0
      N7:4
 ----| |-----
       2
 [3]
           HEATER 3
           CHAMBER
 DOOR 6    GATE VALVE
 CLOSED    CLOSED
 DRCL6S    HV5S1
  I:026      I:024
 --|/|------|/|--
   02         00
 DWELL 3
 CHAMBER
 GATE VALVE
 CLOSED
 HV6S1
     I:024
 ----|/|-----
      03
 DWELL 4
 CHAMBER
 GATE VALVE
 CLOSED
 HV7S1
     I:036
 ----|/|-----
      06
 BUFFER 3
 CHAMBER
 GATE VALVE
 CLOSED
 HV8S1
     I:040
 ----|/|-----
      00
 ABORT SYSTEM
 VENT
 BORT_SYS_VNT
      N7:17
 -----| |-----
       10
 [3]
```

Rung #054

```
|DWELL 5                                                                              |
|CHAMBER                                                                              |
|PRESSUR AT                                                   CHAMBER VENT 4          |
|ATMOSPHERE                                                   CLOSE DELAY             |
|PS5                                                          CV4_DLY                 |
|  I:036                                                      +-TON------------+      |
|---] [--------------------------------------------------------+TIMER ON DELAY  +-(EN)-|
|   04                                                        |TIMER:    T4:320|      |
|                                                             |BASE (SEC):  1.0+-(DN) |
| T4:320.DN - -] [- - File #2 MAIN_PRGRM - 55                 |PRESET:        2|      |
|                                                             |ACCUM:         0|      |
|                                                             +----------------+      |
```

```
Rung #055
                                                                                    OPEN
                                                                                    DWELL 5
                                                                                    VENT VALVE
                                                                                    CV4
 CV4_DLY                                                                              O:043
  T4:320
--] [--------------------------------------------------------------------------------(U)--
   DN                                                                                  16
 [54]
                      O:043/16 - ] [ - File #5 FAULTS - 152
 MANUAL                                File #6 TECH_RUNGS - 0
 CONTROL                        ]/[ - File #2 MAIN_PRGRM - 368
 CHAMBER                               File #5 FAULTS - 154
 VENT VALVE                     -(L)- - File #2 MAIN_PRGRM - 403
 4 CLOSE
 M-CV4-0
    N7:4
 ---] [------
     3
 [3]
 BUFFER 3
 CHAMBER
 GATE VALVE    DOOR 8
 CLOSED        CLOSED
 HV8S1         DRCL8S
   I:040        I:042
 ---]/[---------]/[---
    00           02
 DWELL 5
 CHAMBER
 GATE VALVE
 CLOSED
 HV9S1
   I:040
 ---]/[--------------
    03
 DWELL 6
 CHAMBER
 GATE VALVE
 CLOSED
 HV10S1
   I:052
 ---]/[--------------
    06
 BUFFER 4
 CHAMBER
 GATE VALVE
 CLOSED
 HV11S1
   I:054
 ---]/[--------------
    00
 ABORT SYSTEM
 VENT
 BORT_SYS_VNT
   N7:17
 ---] [--------------
     10
  [3]
```

Rung #056

```
|  OPEN                    CHROME              DWELL 1     MECHANICAL                        OPEN      |
|  ROUGHING                CHAMBER             CHAMBER     PUMP 2                            DWELL 2   |
|  VALVES                  =<250      BLOWER 2 VENT VALVE  ISOLATION                         ROUGH     |
|  1->5                    MICRONS    ENABLED  CLOSED      VALVE OPEN                        VALVE     |
|  OP_RV1->5               PIR6       BL2      CVS3        MP2IVOP                           RV2       |
|      B3                    I:024    O:027     I:002       I:025                            O:030     |
|-+-+-+--] [----------+-+----]/[------] [-------] [---------] [--------------------------------( )----|
| | | |  309          | |     07       01        13          13                               11
| | | [104]           | |             [74]
| | |           OPEN ROUGH  | |
| | |PUMP AREA  VALVE 2,3,OR | |
| | |2 ENABLE   4 DELAY     | |
| | |PUMP2E     P2-4RVTMR   | |
| | |  N7:37       T4:3     | |
| | +---] [-------] [-------+ |
| |      14         DN        |
| |  [438]       [445]        |
| |MANUAL ROUGH               |
| |PUMP VALVE                 |
| |2 OPEN                     |
| |MRPV2OP                    |
| |   N7:28                   |
| +----] [--------------------+
|       1
|  [504]
O:030/11 - -] [- - File #5 FAULTS -  163
                   File #6 TECH_RUNGS -  0
           -]/[- - File #5 FAULTS -  165
           -( )- - File #2 MAIN_PRGRM -  56
```

Rung #057

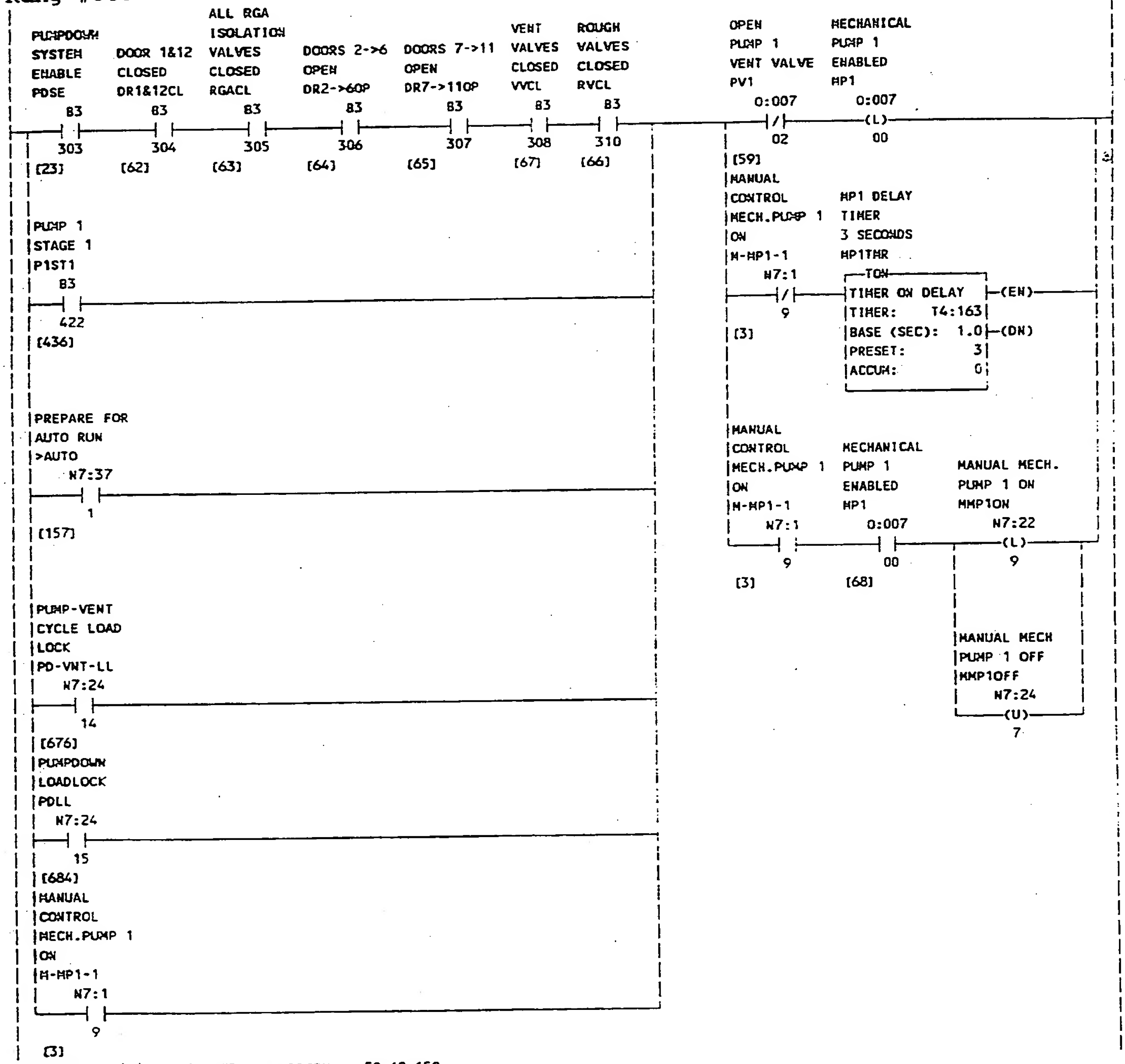
```
|  OPEN                    MAGNETIC            DWELL 4     MECHANICAL                        OPEN      |
|  ROUGHING                CHAMBER             CHAMBER     PUMP 2                            DWELL 4   |
|  VALVES                  =<250      BLOWER 2 VENT VALVE  ISOLATION                         ROUGH     |
|  1->5                    MICRONS    ENABLED  CLOSED      VALVE OPEN                        VALVE     |
|  OP_RV1->5               PIR11      BL2      CVS5        MP2IVOP                           RV3       |
|      B3                    I:040    O:027     I:022       I:025                            O:044     |
|-+-+-+--] [----------+-+----]/[------] [-------] [---------] [--------------------------------( )----|
| | | |  309          | |     07       01        11          13                               11
| | | [104]           | |             [74]
| | |           OPEN ROUGH  | |
| | |PUMP AREA  VALVE 2,3,OR | |
| | |3 ENABLE   4 DELAY     | |
| | |PUMP3E     P2-4RVTMR   | |
| | |  N7:37       T4:3     | |
| | +---] [-------] [-------+ |
| |      15         DN        |
| |  [442]       [445]        |
| |MANUAL ROUGH               |
| |PUMP VALVE                 |
| |3 OPEN                     |
| |MRPV3OP                    |
| |   N7:28                   |
| +----] [--------------------+
|       2
|  [505]
O:044/11 - -] [- - File #5 FAULTS -  167
                   File #6 TECH_RUNGS -  0
           -]/[- - File #5 FAULTS -  169
           -( )- - File #2 MAIN_PRGRM -  57
```

```
Rung #058
|  OPEN                              CARBON              DWELL 5        MECHANICAL                          OPEN       |
|  ROUGHING                          CHAMBER             CHAMBER        PUMP 2                              DWELL 6    |
|  VALVES                            =<250     BLOWER 2  VENT VALVE     ISOLATION                           ROUGH      |
|  1->5                              MICRONS   ENABLED   CLOSED         VALVE OPEN                          VALVE      |
|  OP_RV1->5                         PIR16     BL2       CVS7           MP2IVOP                             RV4        |
|     B3                             I:054     O:027     I:036          I:025                                O:060     |
|-+-+-+---] [---------------+-+-------]/[-------] [-------] [-----------] [----------------------------------( )------|
| | | |    309              | |       07        01        11             13                                  11       |
| | | |[104]                | |                [74]
| | | |             OPEN ROUGH | |
| | | |PUMP AREA    VALVE 2,3,OR | |
| | | |4 ENABLE     4 DELAY    | |
| | | |PUMP4E       P2-4RVTMR  | |
| | | |  N7:38           T4:3  | |
| | | +---] [-------------] [---+ |
| | |      0                DN    |
| | |  [447]          [445]       |
| | |MANUAL ROUGH                 |
| | |PUMP VALVE                   |
| | |4 OPEN                       |
| | |MRPV4OP                      |
| | |    N7:28                    |
| | +----] [----------------------+
| |       3
| |  [506]
O:060/11 - -] [- - File #5 FAULTS -  171
                   File #6 TECH_RUNGS -  0
           -]/[- - File #5 FAULTS -  173
           -( )- - File #2 MAIN_PRGRM -  58
Rung #059
|MECHANICAL                                                                                        OPEN
|PUMP 1                                                                                            PUMP 1
|ENABLED                                                                                           VENT VALVE
|MP1                                                                                               PV1
|   O:007                                                                                            O:007
|----] [--------------------------------------------------------------------------------------------( )----
|     00                                                                                              02
|[68]
O:007/02 - -] [- - File #6 TECH_RUNGS -  1
           -]/[- - File #2 MAIN_PRGRM -  68
           -( )- - File #2 MAIN_PRGRM -  59
Rung #060
|MECHANICAL                                                                                        OPEN
|PUMP 2                                                                                            PUMP 2
|ENABLED                                                                                           VENT VALVE
|MP2                                                                                               PV2
|   O:027                                                                                            O:027
|----] [--------------------------------------------------------------------------------------------( )----
|     00                                                                                              02
|[73]
O:027/02 - -] [- - File #6 TECH_RUNGS -  1
           -]/[- - File #2 MAIN_PRGRM -  73
           -( )- - File #2 MAIN_PRGRM -  60
Rung #061
|MECHANICAL                                                                                        OPEN
|PUMP 3                                                                                            PUMP 3
|ENABLED                                                                                           VENT VALVE
|MP3                                                                                               PV3
|   O:057                                                                                            O:057
|----] [--------------------------------------------------------------------------------------------( )----
|     00                                                                                              02
|[78]
```

```
O:057/02 - -| |- - File #6 TECH_RUNGS    1
           -|/|- - File #2 MAIN_PRGRM -  78
           -( )- - File #2 MAIN_PRGRM -  61
Rung #062
|DOOR 1  DOOR 1  DOOR 12  DOOR 12                                     DOOR 1&12 |
|CLOSED  OPEN    CLOSED   OPEN                                        CLOSED    |
|DRCL1S  DROP1S  DRCL12S  DROP12S                                     DR1&12CL  |
| I:006  I:006   I:056    I:056                                       B3        |
|--| |----|/|----| |-----|/|-----------------------------------------( )-------|
|  00     01      06       07                                         304       |
B3/304 - -| |- - File #2 MAIN_PRGRM -  68
         -( )- - File #2 MAIN_PRGRM -  62
Rung #063
|                           RGA 2      RGA 2      RGA 3      RGA 3      RGA 4      RGA 4        ALL RGA    |
|                           ISOLATION  ISOLATION  ISOLATION  ISOLATION  ISOLATION  ISOLATION    ISOLATION  |
|RGA VALVE     RGA VALVE    VALVE      VALVE      VALVE      VALVE      VALVE      VALVE        VALVES     |
|SENSOR CLOSED SENSOR OPEN  CLOSED     OPEN       CLOSED     OPEN       CLOSED     OPEN         CLOSED     |
|RGAS1_        RGAS2_       RGAS3      RGAS4      RGAS5      RGAS6      RGAS7      RGAS8        RGACL      |
|    I:005        I:005      I:025      I:025      I:041      I:041      I:055      I:055       B3         |
|------| |---------|/|--------| |--------|/|--------| |--------|/|--------| |--------|/|--------( )--------|
|       16           17          16         17         16         17         16         17     305        |
B3/305 - -| |- - File #2 MAIN_PRGRM -  68,391
         -( )- - File #2 MAIN_PRGRM -  63
Rung #064
|DOOR 3  DOOR 3  DOOR 4  DOOR 4  DOOR 5  DOOR 5  DOOR 6  DOOR 6                  DOORS 2->6 |
|CLOSED  OPEN    CLOSED  OPEN    CLOSED  OPEN    CLOSED  OPEN                    OPEN       |
|DRCL3S  DROP3S  DRCL4S  DROP4S  DRCL5S  DROP5S  DRCL6S  DROP6S                  DR2->6OP   |
| I:006  I:006   I:006   I:006   I:026   I:026   I:026   I:026                   B3         |
|--|/|----| |-----|/|----| |-----|/|----| |-----|/|----| |-----------------------( )--------|
|  04      05      06      07      00      01      02      03                    306        |
B3/306 - -| |- - File #2 MAIN_PRGRM -  68,391
         -( )- - File #2 MAIN_PRGRM -  64
Rung #065
|DOOR 7  DOOR 7  DOOR 8  DOOR 8  DOOR 9  DOOR 9  DOOR 10  DOOR 10                DOORS 7->11 |
|CLOSED  OPEN    CLOSED  OPEN    CLOSED  OPEN    CLOSED   OPEN                   OPEN        |
|DRCL7S  DROP7S  DRCL8S  DROP8S  DRCL9S  DROP9S  DRCL10S  DROP10S                DR7->11OP   |
| I:042  I:042   I:042   I:042   I:056   I:056   I:056    I:056                  B3          |
|--|/|----| |-----|/|----| |-----|/|----| |-----|/|-----| |----------------------( )---------|
|  00      01      02      03      00      01      02       03                   307         |
B3/307 - -| |- - File #2 MAIN_PRGRM -  68,391
         -( )- - File #2 MAIN_PRGRM -  65
Rung #066
|LLOCK    LLOCK    DWELL 2   DWELL 2  DWELL 4  DWELL 4  DWELL 5  DWELL 5  EXLOCK   EXLOCK               |
|CHAMBER  CHAMBER  CHAMBER   CHAMBER  CHAMBER  CHAMBER  CHAMBER  CHAMBER  CHAMBER  CHAMBER              |
|ROUGH    ROUGH    ROUGH     ROUGH    ROUGH    ROUGH    ROUGH    ROUGH    ROUGH    ROUGH       ROUGH    |
|VALVE    VALVE    VALVE RV2 VALVE    VALVE    VALVE    VALVE    VALVE    VALVE    VALVE       VALVES   |
|CLOSED   OPEN     CLOSED    OPEN     CLOSED   OPEN     CLOSED   OPEN     CLOSED   OPEN        CLOSED   |
|RVS1     RVS2     RVS3      RVS4     RVS5     RVS6     RVS7     RVS8     RVS9     RVS10       RVCL     |
|  I:002   I:002    I:022     I:022    I:036    I:036    I:052    I:052    I:052    I:052      B3       |
|---| |-----|/|------| |-------|/|------| |------|/|------| |------|/|------| |------|/|-------( )------|
|    15      16       15        16       15       16       14       15       16       17       310      |
B3/310 - -| |- - File #2 MAIN_PRGRM -  68,391
         -( )- - File #2 MAIN_PRGRM -  66
Rung #067
|OPEN         DWELL 1      DWELL 1      DWELL 4      DWELL 3      DWELL 5      DWELL 5      OPEN                      |
|LOAD LOCK    CHAMBER      CHAMBER      CHAMBER      CHAMBER      CHAMBER      CHAMBER      EXLOCK          VENT      |
|CHAMBER      VENT VALVE   VENT VALVE   VENT VALVE   VENT VALVE   VENT VALVE   VENT VALVE   CHAMBER         VALVES    |
|VENT VALVE   CLOSED       OPEN         CLOSED       OPEN         CLOSED       OPEN         VENT VALVE      CLOSED    |
|CV1          CVS3         CVS4         CVS5         CVS6         CVS7         CVS8         CV5             VVCL      |
|  O:007        I:002        I:002        I:022        I:022        I:036        I:036      O:057           B3        |
|-----|/|--------| |----------|/|---------| |----------|/|---------| |----------|/|--------|/|-------------( )-------|
|      16          13           14           11           12           11           12        16          308       |
|[173]                                                                                       [346]                    |
```

B3/308 - -| |- - File #2 MAIN_PRGRM -
-( )- - File #2 MAIN_PRGRM - 67

Rung #068



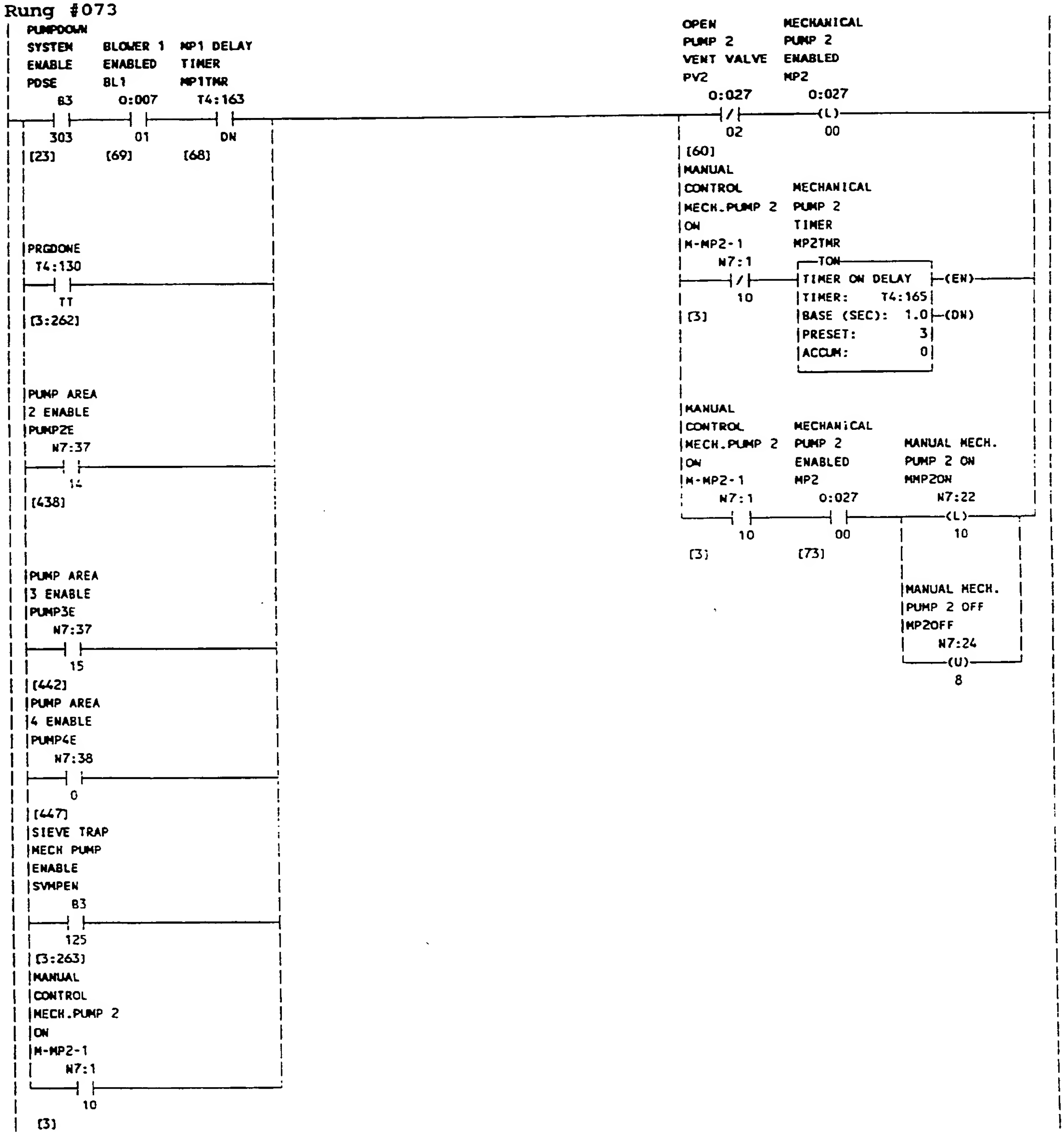
O:007/00 - -| |- - File #2 MAIN_PRGRM - 59,69,158
File #5 FAULTS - 182
File #6 TECH_RUNGS - 0
-(L)- - File #2 MAIN_PRGRM - 68

```
        -(U)- - File #2 MAIN_PRGRM    89
T4:163.DN - -| |- - File #2 MAIN_PRGRM -  69,73,78
N7:22/9 - -(L)- - File #2 MAIN_PRGRM -  68
        -(U)- - File #2 MAIN_PRGRM -  89
_F:N7:21[X21 - BTW - File #2 MAIN_PRGRM -  2
N7:24/7 - -(L)- - File #2 MAIN_PRGRM -  89
        -(U)- - File #2 MAIN_PRGRM -  68
_F:N7:21[X21 - BTW - File #2 MAIN_PRGRM -  2
Rung #069
|             MECHANICAL
| MP1 DELAY   PUMP 1      BLOWER 1                              BLOWER 1
| TIMER       ENABLED     DISABLE                               ENABLED
| MP1TMR      MP1         BL1D                                  BL1
|  T4:163      O:007       B3                                    O:007
|----| |-------| |---------|/|-----------------------------------+--(L)--+--
| |    DN   |    00         122                                  |   01   |
| |[68]     | [68]       [86]                                    |        |
| |         |                                                    |MANUAL  |
| |         | O:007/01 - -| |- - File #2 MAIN_PRGRM - 70, 73, 158, 167, 455
| |MANUAL   |                   File #5 FAULTS - 182             |CONTROL |
| |CONTROL  |                   File #6 TECH_RUNGS - 0           |BLOWER 1     MANUAL BLOWER
| |BLOWER 1 |               -|/|- - File #2 MAIN_PRGRM - 87, 89  |ON           1 ON
| |ON       |               -(U)- - File #2 MAIN_PRGRM - 86      |M-BL1-1      MBL1ON
| |M-BL1-1  | N7:22/12 - -(U)- - File #2 MAIN_PRGRM - 86         |  N7:1          N7:22
| |  N7:1   | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2        +--| |----+----(L)----+
| +---| |---+ N7:24/10 - -(L)- - File #2 MAIN_PRGRM - 86            12     |     12
|     12      _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2        [3]       |
| [3]                                                                      |MANUAL BLOWER
|                                                                          |1 OFF
|                                                                          |MBL1OFF
|                                                                          |    N7:24
|                                                                          +----(U)----+
|                                                                               10
Rung #070
|                                                                MP1 ISOL
|BLOWER 1                                                        VALVE
|ENABLED                                                         OPEN DELAY
|BL1                                                             MP1IVOPDY
|  O:007                                                         +-TON------------+
|----| |---------------------------------------------------------+TIMER ON DELAY  +-(EN)-
|     01                                                         |TIMER:     T4:95|
|[69]                                                            |BASE (SEC):  1.0+-(DN)
|                                                                |PRESET:       10|
|                                                                |ACCUM:        10|
|                                                                +----------------+
T4:95.TT - -| |- - File #2 MAIN_PRGRM -  71
Rung #071
|                                                                BLOWER 1
|                                                                DELAY TO
|                                                                START MP1IV
|MP1IVOPDY                                                       BL1DLY
|  T4:95                                                         +-TOF------------+
|----| |---------------------------------------------------------+TIMER OFF DELAY +-(EN)-
|     TT                                                         |TIMER:      T4:5|
|[70]                                                            |BASE (SEC):  1.0+-(DN)
|                                                                |PRESET:        5|
|                                                                |ACCUM:         5|
|                                                                +----------------+
T4:5.TT - -| |- - File #2 MAIN_PRGRM -  72
```

Rung #072

```
|                                                                    MECHANICAL PUMP |
|                                                                    1 ISOLATION     |
|                                                                    VALVE           |
|BL1DLY                                                              MP1IV           |
| T4:5                                                                   O:010       |
|--| |---------------------------------------------------------------(L)-----------|
|   TT                                                                    03         |
|[71]
O:010/03 - -| |- - File #2 MAIN_PRGRM -  83
           -(L)- - File #2 MAIN_PRGRM -  72
           -(U)- - File #2 MAIN_PRGRM -  84
```

Rung #073


PUMPDOWN SYSTEM ENABLE PDSE
B3
303
[23]
BLOWER 1 ENABLED BL1
0:007
01
[69]
MP1 DELAY TIMER MP1TMR
T4:163
DN
[68]
PRGDONE
T4:130
TT
[3:262]
PUMP AREA 2 ENABLE PUMP2E
N7:37
14
[438]
PUMP AREA 3 ENABLE PUMP3E
N7:37
15
[442]
PUMP AREA 4 ENABLE PUMP4E
N7:38
0
[447]
SIEVE TRAP MECH PUMP ENABLE SVMPEN
B3
125
[3:263]
MANUAL CONTROL MECH.PUMP 2 ON M-MP2-1
N7:1
10
[3]
OPEN PUMP 2 VENT VALVE PV2
0:027
02
[60]
MECHANICAL PUMP 2 ENABLED MP2
0:027
(L)
00
MANUAL CONTROL MECH.PUMP 2 ON M-MP2-1
N7:1
10
[3]
MECHANICAL PUMP 2 TIMER MP2TMR
TON
TIMER ON DELAY
TIMER: T4:165
BASE (SEC): 1.0
PRESET: 3
ACCUM: 0
(EN)
(DN)
MANUAL CONTROL MECH.PUMP 2 ON M-MP2-1
N7:1
10
[3]
MECHANICAL PUMP 2 ENABLED MP2
0:027
00
[73]
MANUAL MECH. PUMP 2 ON MMP2ON
N7:22
(L)
10
MANUAL MECH. PUMP 2 OFF MP2OFF
N7:24
(U)
8

```
O:027/00 - -| |- - File #2 MAIN_PRGRM    60,74
                   File #5 FAULTS -  184
                   File #6 TECH_RUNGS -  0,15
          -(L)- - File #2 MAIN_PRGRM -  73
          -(U)- - File #2 MAIN_PRGRM -  96
T4:165.DN - -| |- - File #2 MAIN_PRGRM -  74,78
N7:22/10 - -(L)- - File #2 MAIN_PRGRM -  73
          -(U)- - File #2 MAIN_PRGRM -  96
_F:N7:21L%21 - BTW - File #2 MAIN_PRGRM -  2
N7:24/8 - -(L)- - File #2 MAIN_PRGRM -  96
         -(U)- - File #2 MAIN_PRGRM -  73
_F:N7:21L%21 - BTW - File #2 MAIN_PRGRM -  2
```

Rung #074

```
 BLOWER 2    MECHANICAL                                   BLOWER 2
 DELAY       PUMP 2       BLOWER 2                        ENABLED
 MP2TMR      ENABLED      DISABLE                         BL2
  T4:165     MP2          BL2D                             O:027
             O:027        B3
|---| |--+---| |------]/[---------------------------+------(L)-----+
    DN   |   00           123                       |      01      |
 [73]    |   [73]         [93]                      |              |
         |                                          | MANUAL       |
         | O:027/01 - -| |- - File #2 MAIN_PRGRM - 56, 57, 58, 74, 75, 78,
         |                    445                   | CONTROL      |
 MANUAL  |                    File #3 CRYO_REGEN - 10, 11, 15, 16, 117, 118,
 CONTROL |                    119, 120, 121, 122, 123, 124, 125, 126, 127,
 BLOWER 2|                    128, 129, 130, 131, 132, 133, 134, 135, 136,
 ON      |                    137, 138, 139, 140, 141, 164, 165, 166, 167,
 M-BL2-1 |                    168, 169, 170, 171, 172, 173, 174, 175, 177,
  N7:1   |                    179, 181, 183, 185, 187
|---| |--+                    File #5 FAULTS - 184
    13                        File #6 TECH_RUNGS - 0, 15
 [3]                 -]/[- - File #2 MAIN_PRGRM - 94, 96
          -(U)- - File #2 MAIN_PRGRM - 93
 N7:22/13 - -(U)- - File #2 MAIN_PRGRM - 93
 _F:N7:21L%21 - BTW - File #2 MAIN_PRGRM - 2
 N7:24/11 - -(L)- - File #2 MAIN_PRGRM - 93
 _F:N7:21L%21 - BTW - File #2 MAIN_PRGRM - 2

                                        BLOWER 2   BLOWER 2   MANUAL BLOWER
                                        ON         ENABLED    2 ON
                                        M-BL2-1    BL2        MBL2ON
                                         N7:1      O:027       N7:22
                                        |---| |------| |--+----(L)----+
                                            13       01   |    13     |
                                        [3]      [74]     | MANUAL BLOWER
                                                          | 2 OFF     |
                                                          | MBL2OFF   |
                                                          |    N7:24  |
                                                          +----(U)----+
                                                               11
```

Rung #075

```
 BLOWER 2                                               MP2 ISOL
 ENABLED                                                VALVE
 BL2                                                    OPEN DELAY
  O:027                                                 MP2IVOPDY
|---| |-----------------------------------------------+-TON--------------+
    01                                                |TIMER ON DELAY   |-(EN)-
 [74]                                                 |TIMER:      T4:96|
                                                      |BASE (SEC):   1.0|-(DN)
                                                      |PRESET:        10|
                                                      |ACCUM:          0|
                                                      +-----------------+

T4:96.TT - -| |- - File #2 MAIN_PRGRM -  76
```

Rung #076

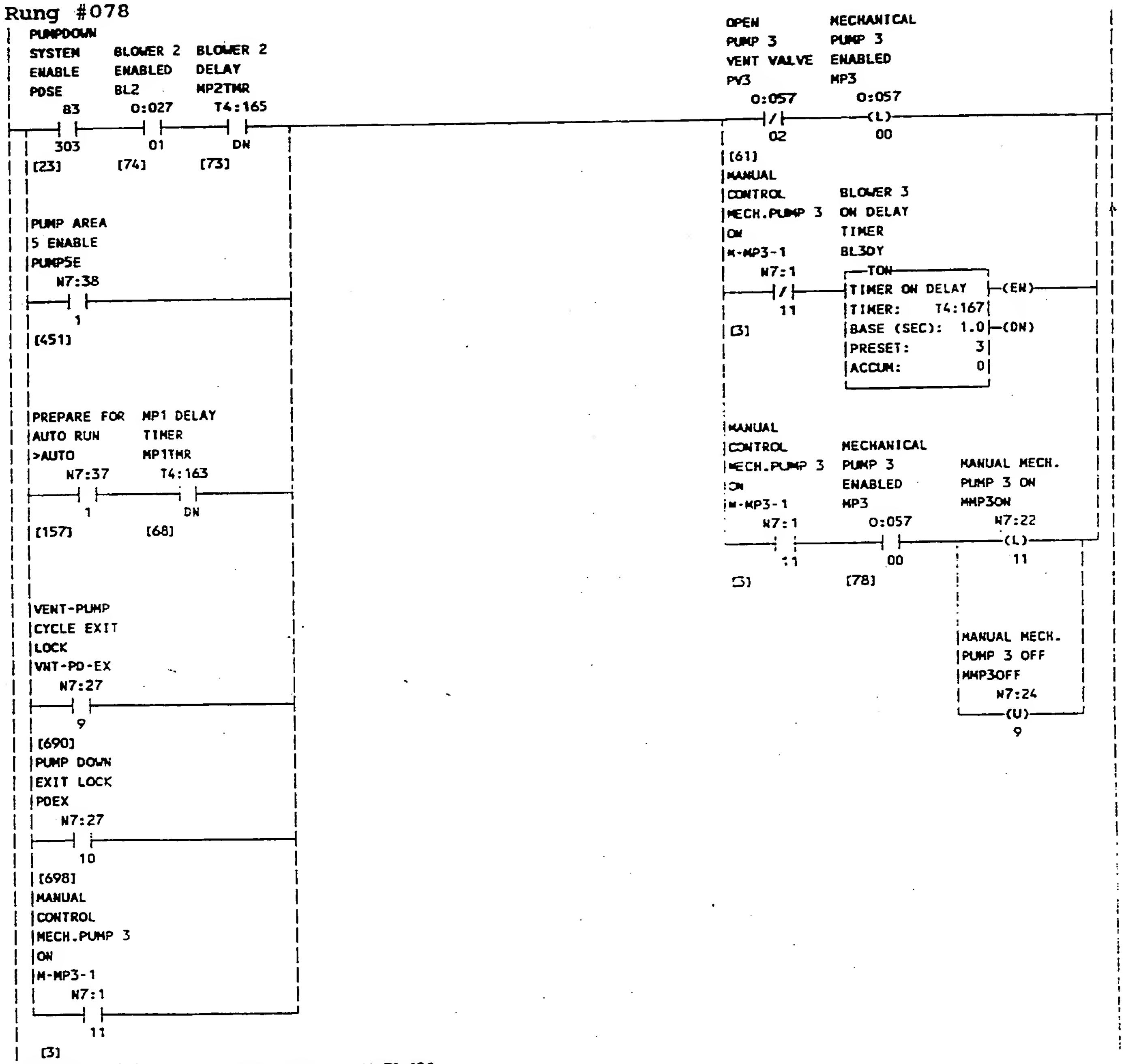
```
                                                        BLOWER 2
                                                        DELAY TO
                                                        START MP2IV
 MP2IVOPDY                                              BL2DLY
  T4:96                                               +-TOF--------------+
|---| |-----------------------------------------------|TIMER OFF DELAY  |-(EN)-
    TT                                                |TIMER:      T4:10|
 [75]                                                 |BASE (SEC):   1.0|-(DN)
                                                      |PRESET:        48|
                                                      |ACCUM:         48|
                                                      +-----------------+
```

```
T4:10.TT - -| |- - File #2 MAIN_PRGRM    7
           -|/|- - File #2 MAIN_PRGRM -  91
```

Rung #077

```
|                                                              MECHANICAL PUMP |
|                                                              2 ISOLATION     |
|                                                              VALVE           |
|BL2DLY                                                        MP2IV           |
| T4:10                                                            O:030       |
|-| |---------------------------------------------------------------(L)--------|
|  TT                                                                03        |
|[76]                                                                          |
O:030/03 - -| |- - File #2 MAIN_PRGRM -  90
           -(L)- - File #2 MAIN_PRGRM -  77
           -(U)- - File #2 MAIN_PRGRM -  91
```

Rung #078



O:057/00 - -| |- - File #2 MAIN_PRGRM - 61,79,158
File #5 FAULTS - 186
File #6 TECH_RUNGS - 0
-(L)- - File #2 MAIN_PRGRM - 78
-(U)- - File #2 MAIN_PRGRM - 103
T4:167.DN - -| |- - File #2 MAIN_PRGRM - 79
N7:22/11 - -(L)- - File #2 MAIN_PRGRM - 78

```
        -(U)- - File #2 MAIN_PRGRM   103
_F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2
N7:24/9 - -(L)- - File #2 MAIN_PRGRM - 103
        -(U)- - File #2 MAIN_PRGRM - 78
_F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2
Rung #079
|                 MECHANICAL
| BLOWER 3        PUMP 3      BLOWER 3                             BLOWER 3
| ENABLE DELAY    ENABLED     DISABLE                              ENABLED
| BL3DY           MP3         BL3D                                 BL3
|    T4:167        O:057        B3                                  O:057
|-----] [---------] [---------]/[-------------------------------+----(L)----
| |     DN       |  00         124                              |   01
| |[78]          | [78]       [100]                             |
| |              |                                              |MANUAL
| |              | O:057/01 - ] [ - File #2 MAIN_PRGRM - 79, 80, 158, 340, 456
| |MANUAL        |           File #5 FAULTS - 186               |CONTROL
| |CONTROL       |           File #6 TECH_RUNGS - 0             |BLOWER 3  BLOWER 3   MANUAL BLOWER
| |BLOWER 3      |      ]/[ - File #2 MAIN_PRGRM - 101, 103     |ON        ENABLED    3 ON
| |ON            |     -(U)- - File #2 MAIN_PRGRM - 100         |M-BL3-1   BL3        MB3ON
| |M-BL3-1       | N7:22/14 - -(U)- - File #2 MAIN_PRGRM - 100  |  N7:1     O:057         N7:22
| |  N7:1        | _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2  +---] [------] [----+----(L)----
| +---] [--------+ N7:24/12 - -(L)- - File #2 MAIN_PRGRM - 100     14        01     |     14
|      14          _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2  [3]       [79]      |
|   [3]                                                                             |
|                                                                                   |MANUAL BLOWER
|                                                                                   |3 OFF
|                                                                                   |MBL3OFF
|                                                                                   |    N7:24
|                                                                                   +----(U)----
|                                                                                        12
Rung #080
|                                                                       MP3 ISOL.
|BLOWER 3                                                               VALVE
|ENABLED                                                                OPEN DELAY
|BL3                                                                    MP3IVOPDY
| O:057                                                                 +-TON-----------------+
|---] [-----------------------------------------------------------------+TIMER ON DELAY       +-(EN)-
|   01                                                                  |TIMER:         T4:97 |
|[79]                                                                   |BASE (SEC):      1.0 +-(DN)
|                                                                       |PRESET:           10 |
|                                                                       |ACCUM:            10 |
|                                                                       +---------------------+
T4:97.TT - ] [ - File #2 MAIN_PRGRM - 81
Rung #081
|                                                                       BLOWER 3
|                                                                       DELAY TO
|                                                                       START MP3IV
|MP3IVOPDY                                                              BL3DLY
|  T4:97                                                                +-TOF-----------------+
|---] [-----------------------------------------------------------------+TIMER OFF DELAY      +-(EN)-
|   TT                                                                  |TIMER:        T4:164 |
|[80]                                                                   |BASE (SEC):      1.0 +-(DN)
|                                                                       |PRESET:            5 |
|                                                                       |ACCUM:             5 |
|                                                                       +---------------------+
T4:164.TT - ] [ - File #2 MAIN_PRGRM - 82
```

```
Rung #082                                                                MECHANICAL PUMP |
|                                                                        3 ISOLATION     |
|                                                                        VALVE           |
|                                                                        MP3IV           |
|BL3DLY                                                                     O:060        |
| T4:164                                                                                 |
|-] [-----------------------------------------------------------------------(L)---------|
|  TT                                                                        03          |
|[81]                                                                                    |
O:060/03 - -] [- - File #2 MAIN_PRGRM -  97
           -(L)- - File #2 MAIN_PRGRM -  82
           -(U)- - File #2 MAIN_PRGRM -  98
Rung #083                                                                                |
|MANUAL                                                                   BLOWER 1       |
|CONTROL   MECHANICAL PUMP                                                MANUAL OFF     |
|BLOWER 1  1 ISOLATION                                                    PULSE          |
|OFF       VALVE                                                          BL1MANOFF      |
|M-BL1-O   MP1IV                                                             B3          |
|  N7:3       O:010                                                                      |
|-] [---------] [-----------------------------------------------------------(L)---------|
|   10         03                                                           317          |
|[3]      [84]                                                                           |
B3/317 - -]/[- - File #2 MAIN_PRGRM -  89
         -(L)- - File #2 MAIN_PRGRM -  83
         -(U)- - File #2 MAIN_PRGRM -  88
```

```
Rung #084
 MANUAL                                 LLOCK
 CONTROL                                CHAMBER                          MECHANICAL PUMP
 BLOWER 1                               ROUGH                            1 ISOLATION
 OFF                                    VALVE                            VALVE
 M-BL1-0                                CLOSED                           MP1IV
   N7:3                                 RVS1                                 O:010
                                         I:002
|--+---] [------------------+-----------] [------------------------------------(U)----|
   |    10                   |           15                                     03
   |[3]                      |
   |                         | O:010/03 - ] [ - File #2 MAIN_PRGRM - 83
   |                         |          -(L)- - File #2 MAIN_PRGRM - 72
   |AUTO OFF                 |
   |PULSE                    |
   |AUOFPULSE                |
   |  T4:283                 |
   |---] [-------------------|
   |    TT                   |
   |[155]                    |
   |PUMP1EDPLSE              |
   |  T4:284                 |
   |---] [-------------------|
   |    TT                   |
   |[437]                    |
   |PDSOPLSE                 |
   |  T4:285                 |
   |---] [-------------------|
   |    TT                   |
   |[22]                     |
   |SYSTEM                   |
   |VENT                     |
   |ENABLE                   |
   |PULSE                    |
   |SYSVNTPLSE               |
   | +-LEQ-------------------+
   |-|LESS THAN OR EQUAL (A<=B)|-|
   | |SOURCE A:        T4:286 |
   | |                    606 |
   | |SOURCE B:             3 |
   | |                      3 |
   | +------------------------+
   |T4:286 - [370]           |
   |PUMPDOWN                 |
   |LOADLOCK    AUTO         |
   |DISABLE     MODE         |
   |PULSE       ENABLE       |
   |PDLLDPLSE   AUTO         |
   |  T4:287    N7:37        |
   +---] [--------]/[--------+
        TT        11
  [686]        [155]
Rung #085
|MECH. PUMP 1
|ISOL. VALVE                                                   UNLATCH BL1
|CLOSE SENSOR                                                  PULSE
|MP1IVCL                                                       UNL_BL1_PL
|     I:005                                                    +-TON-----------+
|------] [-----------------------------------------------------|TIMER ON DELAY |-(EN)-|
|      14                                                      |TIMER:   T4:289|
|                                                              |BASE (SEC): 1.0|-(DN)
| T4:289.TT - ] [ - File #2 MAIN_PRGRM - 86                    |PRESET:      10|
|                                                              |ACCUM:        0|
>                                                              >>>>>>>>>>>>>>>>>>   >
```

```
Rung #086                                                                     BLOWER 1
                                                                              ENABLED
                                                                              BL1
|UNL_BL1_PL                                                                    O:007
|  T4:289                                                                   +--(U)--+
|---| |-----------------------------------------------------------------------+  01   |
|    TT                                                                      |       |
|[85]                                                                        |BLOWER 1
| O:007/01 - -| |- - File #2 MAIN_PRGRM - 70, 73, 158, 167, 455              |DISABLE
|                    File #5 FAULTS - 182                                    |BL1D
|                    File #6 TECH_RUNGS - 0                                  |  B3
|            -|/|- - File #2 MAIN_PRGRM - 87, 89                             +--( )--+
|            -(L)- - File #2 MAIN_PRGRM - 69                                 |  122
| B3/122 - -|/|- - File #2 MAIN_PRGRM - 69                                   |
| N7:22/12 - -(L)- - File #2 MAIN_PRGRM - 69                                 |
| _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                                |
| N7:24/10 - -(U)- - File #2 MAIN_PRGRM - 69                                 |MANUAL BLOWER
| _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                                |1 ON
|                                                                            |MBL1ON
|                                                                            |   N7:22
|                                                                            +---(U)---+
|                                                                            |   12
|                                                                            |MANUAL BLOWER
|                                                                            |1 OFF
|                                                                            |MBL1OFF
|                                                                            |   N7:24
|                                                                            +---(L)---+
|                                                                                10
Rung #087                                                               BLOWER 1
|                                                                       OFF-AUTO
|BLOWER 1                                                               PULSE
|ENABLED                                                                BL1OFFPLSE
|BL1                                                                    +-TON-------------+
| O:007                                                                 |TIMER ON DELAY   |-(EN)-
|---|/|-----------------------------------------------------------------|TIMER:    T4:292|
|    01                                                                 |BASE (SEC):  1.0|-(DN)
|[86]                                                                   |PRESET:        8|
|                                                                       |ACCUM:         0|
|                                                                       +-----------------+
T4:292.DN - -| |- - File #2 MAIN_PRGRM - 88
T4:292.TT - -| |- - File #2 MAIN_PRGRM - 89
Rung #088                                                                    BLOWER 1
|                                                                            MANUAL OFF
|                                                                            PULSE
|                                                                            BL1MANOFF
|BL1OFFPLSE                                                                     B3
|  T4:292
|---| |-------------------------------------------------------------------------(U)---
|    DN                                                                         317
|[87]
B3/317 - -|/|- - File #2 MAIN_PRGRM - 89
         -(L)- - File #2 MAIN_PRGRM - 83
         -(U)- - File #2 MAIN_PRGRM - 88
```

```
Rung #089
|                                                                               MECHANICAL     |
|            BLOWER 1                                                           PUMP 1         |
|            MANUAL OFF    BLOWER 1                                             ENABLED        |
|            PULSE         ENABLED                                              MP1            |
|  BL1OFFPLSE BL1MANOFF    BL1                                                    O:007       |
|    T4:292     B3          O:007                                                              |
|----] [-------]/[-------+----]/[--------------------------------------------+------(U)-------+-|
| |    TT       317      |    01                                              |      00        | |
| |[87]        [88]      | [86]                                               |                | |
| |MANUAL                | O:007/00 - ] [ - File #2 MAIN_PRGRM - 59, 68, 69, 158                | |
| |CONTROL               |              File #5 FAULTS - 182                  |MANUAL MECH.    | |
| |MECHANICAL            |              File #6 TECH_RUNGS - 0                |PUMP 1 ON       | |
| |PUMP 1                |        -(L)- - File #2 MAIN_PRGRM - 68             |MMP1ON          | |
| |OFF                   | N7:22/9 - -(L)- - File #2 MAIN_PRGRM - 68          |   N7:22        | |
| |M-MP1-0               | _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2        +------(U)-------+ |
| |    N7:3              | N7:24/7 - -(U)- - File #2 MAIN_PRGRM - 68          |       9        | |
| +----] [---------------+ _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2         |                | |
|       7                                                                      |                | |
|  [3]                                                                        |MANUAL MECH     | |
|                                                                             |PUMP 1 OFF      | |
|                                                                             |MMP1OFF         | |
|                                                                             |   N7:24        | |
|                                                                             +------(L)-------+ |
|                                                                                    7           

Rung =090
|MANUAL
|CONTROL   MECHANICAL PUMP                                                    BLOWER 2     |
|BLOWER 2  2 ISOLATION                                                        MANUAL OFF   |
|OFF       VALVE                                                              PULSE        |
|M-BL2-0   MP2IV                                                              BL2MANOFF    |
|  N7:3         C:030                                                           B3         |
|----] [----------] [------------------------------------------------------------(L)-------|
|   11            C3                                                             318       |
|[3]      [91]
B3/318 - ]/[ - File #2 MAIN_PRGRM - 96
        -(L)- - File #2 MAIN_PRGRM - 90
        -(U)- - File #2 MAIN_PRGRM - 95
```

```
Rung #091
|                                                     DWELL 2      DWELL 4   DWELL 5
|                                                     CHAMBER      CHAMBER   CHAMBER
|                                                     ROUGH        ROUGH     ROUGH                    MECHANICAL PUMP
|                                                     VALVE RV2    VALVE     VALVE                    2 ISOLATION
|                                                     CLOSED       CLOSED    CLOSED                   VALVE
|  PDSDPLSE                                           RVS3         RVS5      RVS7                     MP2IV
|   T4:285                                              I:022      I:036     I:052                      O:030
|-+---| |------------------------------------------+------| |--------| |-------| |--------------------------(U)---|
| |    TT                                          |        15         15        14                           03
| |[22]                                            |
| |                                                | O:030/03 - -| |- - File #2 MAIN_PRGRM - 90
| |                                                |            -(L)- - File #2 MAIN_PRGRM - 77
| |DISABLE                                         |
| |MP2 & BL2                                       |
| |CRMPBL2D                                        |
| |  T4:170                                        |
| |---| |----------------------------------------+
| |    TT                                          |
| |[3:261]                                         |
| |SYSTEM                                          |
| |VENT                                            |
| |ENABLE                                          |
| |PULSE                                           |
| |SYSVNTPLSE                                      |
| | +-LEQ-------------------------+                |
| |-|LESS THAN OR EQUAL (A<=B)    |----------------+
| | |SOURCE A:            T4:286  |                |
| | |                        606  |                |
| | |SOURCE B:                 3  |                |
| | |                          3  |                |
| | +-----------------------------+                |
| |T4:286 - [370]                                  |
| |P2ENDPULSE                                      |
| |  T4:125                                        |
| |---| |----------------------------------------+
| |    TT                                          |
| |[441]                                           |
| |P3ENDPULSE                                      |
| |  T4:126                                        |
| |---| |----------------------------------------+
| |    TT                                          |
| |[446]                                           |
| |P4ENDPULSE                                      |
| |  T4:127                                        |
| |---| |----------------------------------------+
| |    TT                                          |
| |[450]                                           |
| |NO CRYOS BEING  ABORT CRYO                      |
| |REGENERATED     TIMER                           |
| |NO_CYRGN        ABORTCRYO                       |
| |    B3            T4:297                        |
| |----| |-----------| |---------------------------+
| |    233             TT                          |
| |[3:33]           [3:27]                         |
| |                 SIEVE TRAP                     |
| |NO CRYOS BEING   MECH PUMP                      |
| |REGENERATED      DISABLE                        |
| |NO_CYRGN         SVMPDIS       BL2DLY           |
| |    B3              B3          T4:10           |
| |----|/|-----------| |----------|/|--------------+
| |    233            102            TT            |
| |[3:33]           [3:264]        [76]            |
> >                                                >
```

```
< <
| |MANUAL
| |CONTROL
| |BLOWER 2
| |OFF
| |M-BL2-0
| |    N7:3
| |----| |----
|       11
|  [3]
Rung #092
|MECHANICAL PUMP                                          UNLATCH BL2
|2 ISOLATION                                              PULSE
|VALVE CLOSE                                              UNL_BL2_PL
|SENSOR                                                   +--TON--------------+
|MP2IVCL                                                  |TIMER ON DELAY     |-(EN)-
|    I:025                                                |TIMER:      T4:290 |
|----| |--------------------------------------------------|BASE (SEC):   1.0  |-(DN)
|     14                                                  |PRESET:         10 |
|                                                         |ACCUM:          10 |
| T4:290.TT - -| |- - File #2 MAIN_PRGRM - 93             +-------------------+
|
Rung #093
|                                                          BLOWER 2
|                                                          ENABLED
|UNL_BL2_PL                                                BL2
|   T4:290                                                  O:027
|----| |----------------------------------------------------+--(U)--
|      TT                                                  |  01
|[92]                                                      |
| O:027/01 - -| |- - File #2 MAIN_PRGRM - 56, 57, 58, 74, 75, 78, 445
|                     File #3 CRYO_REGEN - 10, 11, 15, 16, 117, 118, 119, 120, 121, 122, 123, 124,
|                     125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139,
|                     140, 141, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 177,
|                     179, 181, 183, 185, 187
|                     File #5 FAULTS - 184                 |BLOWER 2
|                     File #6 TECH_RUNGS - 0, 15           |DISABLE
|            -|/|- - File #2 MAIN_PRGRM - 94, 96           |BL2D
|            -(L)- - File #2 MAIN_PRGRM - 74               |   B3
| B3/123 - -|/|- - File #2 MAIN_PRGRM - 74                 +--( )--
| N7:24/11 - -(U)- - File #2 MAIN_PRGRM - 74               |  123
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2              |
| N7:22/13 - -(L)- - File #2 MAIN_PRGRM - 74               |MANUAL BLOWER
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2              |2 OFF
|                                                          |MBL2OFF
|                                                          |    N7:24
|                                                          +----(L)----
|                                                          |     11
|                                                          |MANUAL BLOWER
|                                                          |2 ON
|                                                          |MBL2ON
|                                                          |    N7:22
|                                                          +----(U)----
|                                                                13
```

```
Rung #094                                                                BLOWER 2
|                                                                        OFF-AUTO
|BLOWER 2                                                                PULSE
|ENABLED                                                                 BL2OFFPLSE
|BL2                                                                     +-TON----------------+
| O:027                                                                  |TIMER ON DELAY      |-(EN)-
|--|/|-------------------------------------------------------------------|TIMER:      T4:293  |
|   01                                                                   |BASE (SEC):   1.0   |-(DN)
|[93]                                                                    |PRESET:        5    |
|                                                                        |ACCUM:         5    |
|                                                                        +--------------------+
T4:293.DN - -| |- - File #2 MAIN_PRGRM -  95
T4:293.TT - -| |- - File #2 MAIN_PRGRM -  96
Rung #095                                                                BLOWER 2
|                                                                        MANUAL OFF
|                                                                        PULSE
|BL2OFFPLSE                                                              BL2MANOFF
| T4:293                                                                    B3
|--| |-------------------------------------------------------------------(U)-----
|   DN                                                                     318
|[94]
B3/318 - -|/|- - File #2 MAIN_PRGRM -  96
         -(L)- - File #2 MAIN_PRGRM -  90
         -(U)- - File #2 MAIN_PRGRM -  95
Rung #096
|               BLOWER 2                                                 MECHANICAL
|               MANUAL OFF     BLOWER 2                                  PUMP 2
|               PULSE          ENABLED                                   ENABLED
|  BL2OFFPLSE   BL2MANOFF      BL2                                       MP2
|   T4:293         B3          O:027                                      O:027
|--+--| |----------|/|--+-------|/|---------------------------------+-----(U)----+-
|  |    TT          318 |        01                                 |      00    |
|  |[94]         [95]   |      [93]                                 |            |
|  |MANUAL              |  O:027/00 - -| |- - File #2 MAIN_PRGRM - 60, 73, 74  |MANUAL MECH.|
|  |CONTROL             |                    File #5 FAULTS - 184  |PUMP 2 ON   |
|  |MECHANICAL          |                    File #6 TECH_RUNGS - 0, 15 |MMP2ON |
|  |PUMP 2              |              -(L)- - File #2 MAIN_PRGRM - 73 |  N7:22  |
|  |OFF                 |  N7:22/10 - -(L)- - File #2 MAIN_PRGRM - 73  +-----(U)----+
|  |M-MP2-O             |  _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2  |     10     |
|  |  N7:3              |  N7:24/8 - -(U)- - File #2 MAIN_PRGRM - 73   |            |
|  +--| |---------------+  _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2  |            |
|      8                                                              |MANUAL MECH.|
|  [3]                                                                |PUMP 2 OFF  |
|                                                                     |MP2OFF      |
|                                                                     |  N7:24     |
|                                                                     +-----(L)----+
|                                                                           8
Rung #097
|MANUAL
|CONTROL   MECHANICAL PUMP                                               BLOWER 3
|BLOWER 3  3 ISOLATION                                                   MANUAL OFF
|OFF       VALVE                                                         PULSE
|M-BL3-O   MP3IV                                                         BL3MANOFF
| N7:3      O:060                                                           B3
|--| |--------| |-------------------------------------------------------(L)-----
|   12         03                                                          319
|[3]         [98]
B3/319 - -|/|- - File #2 MAIN_PRGRM -  103
```

```
        -(L)- - File #2 MAIN_PRGRM -
        -(U)- - File #2 MAIN_PRGRM -  102
Rung #098
|                                  EXLOCK
| SYSTEM                           CHAMBER
| VENT                             ROUGH                                         MECHANICAL PUMP
| ENABLE                           VALVE                                         3 ISOLATION
| PULSE                            CLOSED                                        VALVE
| SYSVNTPLSE                       RVS9                                          MP3IV
|  ┌─LEQ──────────────────────┐     I:052                                            O:060
├┤|LESS THAN OR EQUAL (A<=B)├───┤ ├──────────────────────────────────────────────────(U)───┤
| ||SOURCE A:          T4:286|       16                                                03
| ||                      606|
| ||SOURCE B:               3| O:060/03 - ┤ ├ - File #2 MAIN_PRGRM - 97
| ||                        3|           -(L)- - File #2 MAIN_PRGRM - 82
| |└─────────────────────────┘
| |T4:286 - [370]
| |MANUAL
| |CONTROL
| |BLOWER 3
| |OFF
| |M-BL3-O
| |   N7:3
| ├──┤ ├──────────────────┤
| |    12
| |[3]
| |AUTO OFF
| |PULSE
| |AUOFPULSE
| |  T4:283
| ├───┤ ├─────────────────┤
| |     TT
| |[155]
| |PSENDPULSE
| |  T4:128
| ├───┤ ├─────────────────┤
| |     TT
| |[454]
| |PDSDPLSE
| |  T4:285
| ├──┤ ├──────────────────┤
| |    TT
| |[22]
| |         AUTO
| |         MODE
| |         ENABLE
| |PFEXEND  AUTO
| | T4:222   N7:37
| └──┤ ├────┤/├───────────┘
|     TT       11
| [699]     [155]
Rung #099
|MECHANICAL PUMP
|3 ISOL. VALVE                                                            UNLATCH BL3
|CLOSE SENSOR                                                             PULSE
|MP3IVCL                                                                  UNL_BL3_PL
|      I:055                                                              ┌─TON──────────────┐
├───────┤ ├───────────────────────────────────────────────────────────────┤TIMER ON DELAY    ├─(EN)─┤
|        15                                                               |TIMER:     T4:291|
|                                                                         |BASE (SEC):   1.0├─(DN)
| T4:291.TT - ┤ ├ - File #2 MAIN_PRGRM - 100                              |PRESET:        20|
|                                                                         |ACCUM:          0|
|                                                                         └─────────────────┘
```

Rung #100

```
                                                                     BLOWER 3
                                                                     ENABLED
UNL_BL3_PL                                                           BL3
 T4:291                                                                0:057
--] [--------------------------------------------------------------+---(U)---
   TT                                                              |    01
[99]                                                               |
 O:057/01 - -] [- - File #2 MAIN_PRGRM - 79, 80, 158, 340, 456     |BLOWER 3
                    File #5 FAULTS - 186                           |DISABLE
                    File #6 TECH_RUNGS - 0                         |BL3D
             -]/[- - File #2 MAIN_PRGRM - 101, 103                 |   B3
             -(L)- - File #2 MAIN_PRGRM - 79                       +---( )---
 B3/124 - -]/[- - File #2 MAIN_PRGRM - 79                          |   124
 N7:22/14 - -(L)- - File #2 MAIN_PRGRM - 79                        |
 _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                       |
 N7:24/12 - -(U)- - File #2 MAIN_PRGRM - 79                        |MANUAL BLOWER
 _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                       |3 ON
                                                                   |MB3ON
                                                                   |    N7:22
                                                                   +-----(U)---
                                                                   |     14
                                                                   |MANUAL BLOWER
                                                                   |3 OFF
                                                                   |MBL3OFF
                                                                   |    N7:24
                                                                   +-----(L)---
                                                                         12
```

Rung #101

```
                                                               BLOWER 3
BLOWER 3                                                       OFF-AUTO
ENABLED                                                        PULSE
BL3                                                            BL3OFFPLSE
 0:057                                                         +-TON-------------+
--]/[----------------------------------------------------------|TIMER ON DELAY   |-(EN)-
   01                                                          |TIMER:   T4:294  |
[100]                                                          |BASE (SEC):  1.0 |-(DN)
                                                               |PRESET:        5 |
                                                               |ACCUM:         0 |
                                                               +-----------------+
T4:294.DN - -] [- - File #2 MAIN_PRGRM -  102
T4:294.TT - -] [- - File #2 MAIN_PRGRM -  103
```

Rung #102

```
                                                                   BLOWER 3
                                                                   MANUAL OFF
                                                                   PULSE
BL3OFFPLSE                                                         BL3MANOFF
 T4:294                                                               B3
--] [-----------------------------------------------------------------(U)---
   DN                                                                 319
[101]
B3/319 - -]/[- - File #2 MAIN_PRGRM -  103
         -(L)- - File #2 MAIN_PRGRM -  97
         -(U)- - File #2 MAIN_PRGRM -  102
```

Rung #103

```
            BLOWER 3                                       MECHANICAL
            MANUAL OFF    BLOWER 3                         PUMP 3
            PULSE         ENABLED                          ENABLED
BL3OFFPLSE  BL3MANOFF     BL3                              MP3
  T4:294      B3          O:057                              O:057
---] [--------]/[--------]/[-------------------------------(U)---
   TT        319          01                                 00
[101]       [102]       [100]
MANUAL                  O:057/00 - ] [ - File #2 MAIN_PRGRM - 61, 78, 79, 158    MANUAL MECH.
CONTROL                          File #5 FAULTS - 186                            PUMP 3 ON
MECHANICAL                       File #6 TECH_RUNGS - 0                          MMP3ON
PUMP 3                     -(L)- - File #2 MAIN_PRGRM - 78                         N7:22
OFF                     N7:22/11 - -(L)- - File #2 MAIN_PRGRM - 78              ---(U)---
M-MP3-O                 _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                 11
  N7:3                  N7:24/9 - -(U)- - File #2 MAIN_PRGRM - 78
---] [---               _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2
    9
[3]                                                                   MANUAL MECH.
                                                                      PUMP 3 OFF
                                                                      MMP3OFF
                                                                        N7:24
                                                                      ---(L)---
                                                                          9
```

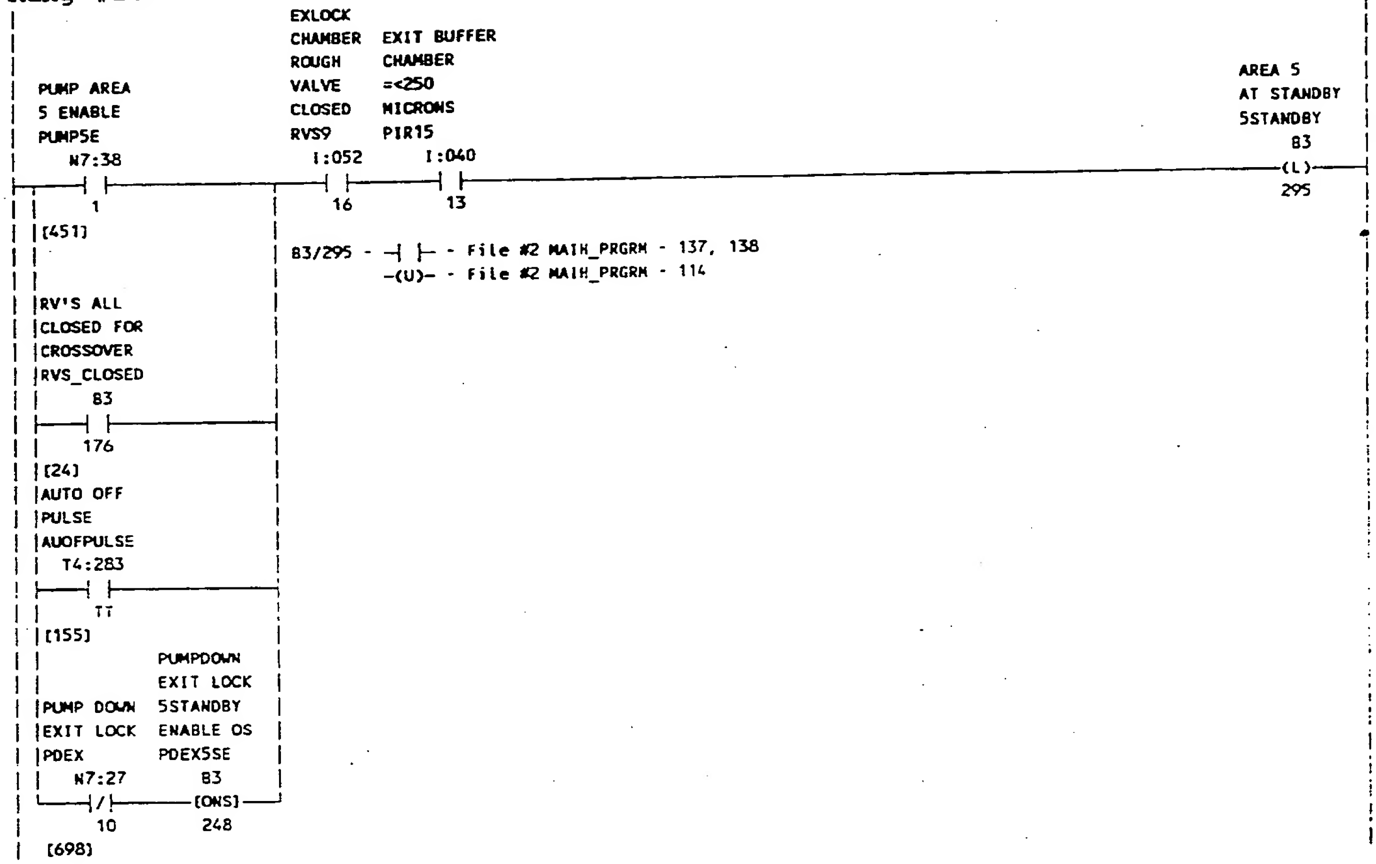
Rung #104

```
                                                                   OPEN
PUMPDOWN                                                           ROUGHING
SYSTEM      OPEN ROUGHING                                          VALVES
ENABLE      VALVES DELAY                                           1->5
PDSE        DROP2_DLY                                              OP_RV1->5
  B3          T4:169                                                 B3
---] [-------] [--------------------------------------------------( )---
  303          DN                                                   309
[23]       [199]
                         B3/309 - ] [ - File #2 MAIN_PRGRM - 56, 57, 58, 167, 340
           AUTO
           MODE
           ENABLE
           AUTO
            N7:37
           ---]/[---
               11
           [155]
```

```
Rung #105
|                 LLOCK
|                 CHAMBER  HEATER 1
|                 ROUGH    CHAMBER
|                 VALVE    =<250                                          AREA 1 AT  |
| PUMP AREA       CLOSED   MICRONS                                        STANDBY    |
| 1 ENABLE        RVS1     PIR2                                           1STANDBY   |
| PUMP1E           I:002    I:004                                            B3      |
|   N7:37                                                                            |
|-+---] [----+-----] [------] [---------------------------------------------(L)-----|
| |   13     |    15        10                                              291     |
| |[434]     |                                                                       |
| |          | B3/291 - ] [ - File #2 MAIN_PRGRM - 115, 117, 118                     |
| |          |        -(U)- - File #2 MAIN_PRGRM - 110                               |
| |RV'S ALL  |                                                                       |
| |CLOSED FOR|                                                                       |
| |CROSSOVER |                                                                       |
| |RVS_CLOSED|                                                                       |
| |   B3     |                                                                       |
| |---] [----|                                                                       |
| |   176    |                                                                       |
| |[24]      |                                                                       |
| |AUTO OFF  |                                                                       |
| |PULSE     |                                                                       |
| |AUOFPULSE |                                                                       |
| |  T4:283  |                                                                       |
| +---] [----+                                                                       |
|     TT                                                                             |
|  [155]
Rung #106
|                 DWELL 2
|                 CHAMBER    CHROME
|                 ROUGH      CHAMBER
| PUMP AREA       VALVE RV2  =<250                                        AREA 2     |
| 2 ENABLE        CLOSED     MICRONS                                      AT STANDBY |
| PUMP2E          RVS3       PIR6                                         2STANDBY   |
|   N7:37          I:022      I:024                                          B3      |
|-+---] [----+-----] [--------] [-------------------------------------------(L)-----|
| |   14     |    15          07                                            292     |
| |[438]     |                                                                       |
| |          | B3/292 - ] [ - File #2 MAIN_PRGRM - 117, 118, 119, 120, 121, 122, 123, 124 |
| |          |        -(U)- - File #2 MAIN_PRGRM - 111                               |
| |RV'S ALL  |                                                                       |
| |CLOSED FOR|                                                                       |
| |CROSSOVER |                                                                       |
| |RVS_CLOSED|                                                                       |
| |   B3     |                                                                       |
| |---] [----|                                                                       |
| |   176    |                                                                       |
| |[24]      |                                                                       |
| |AUTO OFF  |                                                                       |
| |PULSE     |                                                                       |
| |AUOFPULSE |                                                                       |
| |  T4:283  |                                                                       |
| +---] [----+                                                                       |
|     TT                                                                             |
|  [155]
```

```
Rung #107
|                  DWELL 4
|                  CHAMBER  MAGNETIC
|                  ROUGH    CHAMBER
| PUMP AREA        VALVE    =<250                                        AREA 3
| 3 ENABLE         CLOSED   MICRONS                                      AT STANDBY
| PUMP3E           RVS5     PIR11                                        3STANDBY
|   N7:37           I:036    I:040                                          B3
|----| |------------| |------| |--------------------------------------------(L)----
|     15             15       07                                            293
| [442]
|                  B3/293 - -| |- - File #2 MAIN_PRGRM - 125, 126, 127, 128, 129, 130
|                           -(U)- - File #2 MAIN_PRGRM - 112
| RV'S ALL
| CLOSED FOR
| CROSSOVER
| RVS_CLOSED
|     B3
|----| |----
|    176
| [24]
| AUTO OFF
| PULSE
| AUOFPULSE
|  T4:283
|----| |----
|     TT
| [155]
Rung #108
|                  DWELL 5
|                  CHAMBER  CARBON
|                  ROUGH    CHAMBER
| PUMP AREA        VALVE    =<250                                        AREA 4
| 4 ENABLE         CLOSED   MICRONS                                      AT STANDBY
| PUMP4E           RVS7     PIR16                                        4STANDBY
|   N7:38           I:052    I:054                                          B3
|----| |------------| |------| |--------------------------------------------(L)----
|     0              14       07                                            294
| [447]
|                  B3/294 - -| |- - File #2 MAIN_PRGRM - 131, 132, 133, 134, 135, 136
|                           -(U)- - File #2 MAIN_PRGRM - 113
| RV'S ALL
| CLOSED FOR
| CROSSOVER
| RVS_CLOSED
|     B3
|----| |----
|    176
| [24]
| AUTO OFF
| PULSE
| AUOFPULSE
|  T4:283
|----| |----
|     TT
| [155]
```

Rung #109


PUMP AREA
5 ENABLE
PUMP5E
N7:38
1
[451]
EXLOCK
CHAMBER
ROUGH
VALVE
CLOSED
RVS9
I:052
16
EXIT BUFFER
CHAMBER
=<250
MICRONS
PIR15
I:040
13
AREA 5
AT STANDBY
5STANDBY
B3
(L)
295
B3/295 - ┤ ├ - File #2 MAIN_PRGRM - 137, 138
-(U)- - File #2 MAIN_PRGRM - 114
RV'S ALL
CLOSED FOR
CROSSOVER
RVS_CLOSED
B3
176
[24]
AUTO OFF
PULSE
AUOFPULSE
T4:283
TT
[155]
PUMP DOWN
EXIT LOCK
PDEX
N7:27
10
PUMPDOWN
EXIT LOCK
5STANDBY
ENABLE OS
PDEX5SE
B3
[ONS]
248
[698]

```
Rung #110
| SYSTEM                                                                              |
| VENT                                                                      AREA 1 AT |
| ENABLE                                                                    STANDBY   |
| SYSVNTE                                                                   1STANDBY  |
|  N7:37                                                                       B3     |
|-+--] [--+---------------------------------------------------------------------(U)---|
| |   5   |                                                                    291    |
| |[368]  |                                                                           |
| |       | B3/291 - ] [ - File #2 MAIN_PRGRM - 115, 117, 118                          |
| |       |        -(L)- - File #2 MAIN_PRGRM - 105                                    |
| |VENT AREA                                                                          |
| |1 ENABLE                                                                           |
| |VENT1E |                                                                           |
| |  N7:37|                                                                           |
| +--] [--+                                                                           |
| |   6   |                                                                           |
| |[405]  |                                                                           |
| |PREPARE FOR                                                                        |
| |AUTO RUN                                                                           |
| |>AUTO  |                                                                           |
| |  N7:37|                                                                           |
| +--] [--+                                                                           |
| |   1   |                                                                           |
| |[157]  |                                                                           |
| |reset  |                                                                           |
| |RESET  |                                                                           |
| | N7:17 |                                                                           |
| +-] [---+                                                                           |
| |  15   |                                                                           |
| |[3]    |                                                                           |
| |COMPRESSOR                                                                         |
| |2 REGEN-                                                                           |
| |ERATION|                                                                           |
| |PROGRAM|                                                                           |
| |CYRGN2 |                                                                           |
| |   B3  |                                                                           |
| +--] [--+                                                                           |
|    322                                                                              |
|  [3:34]                                                                             |
```

Rung #111

```
| SYSTEM                                                                   AREA 2
| VENT                                                                     AT STANDBY
| ENABLE                                                                   2STANDBY
| SYSVNTE                                                                      B3
|   N7:37
|--+---| |---+-------------------------------------------------------------(U)---|
|  |    5    |                                                             292
|  |[368]    |
|  |         | B3/292 - -| |- - File #2 MAIN_PRGRM - 117, 118, 119, 120, 121, 122, 123, 124
|  |         |          -(L)- - File #2 MAIN_PRGRM - 106
|  |VENT AREA|
|  |2 ENABLE |
|  |VENT2E   |
|  |  N7:37  |
|  |---| |---|
|  |    7    |
|  |[411]    |
|  |PREPARE FOR
|  |AUTO RUN |
|  |>AUTO    |
|  |  N7:37  |
|  |---| |---|
|  |    1    |
|  |[157]    |
|  |reset    |
|  |RESET    |
|  | N7:17   |
|  |-| |-----|
|  |  15     |
|  |[3]      |
|  |COMPRESSOR
|  |3 REGEN- |
|  |ERATION  |
|  |PROGRAM  |
|  |CYRGN3   |
|  |   B3    |
|  |---| |---|
|  |   323   |
|  |[3:38]   |
|  |COMPRESSOR
|  |4 REGEN- |
|  |ERATION  |
|  |PROGRAM  |
|  |CYRGN4   |
|  |   B3    |
|  |---| |---|
|  |   324   |
|  |[3:42]   |
|  |COMPRESSOR
|  |5 REGEN- |
|  |ERATION  |
|  |PROGRAM  |
|  |CYRGN5   |
|  |   B3    |
|  +---| |---+
|      325
|  [3:46]
```

Rung #112

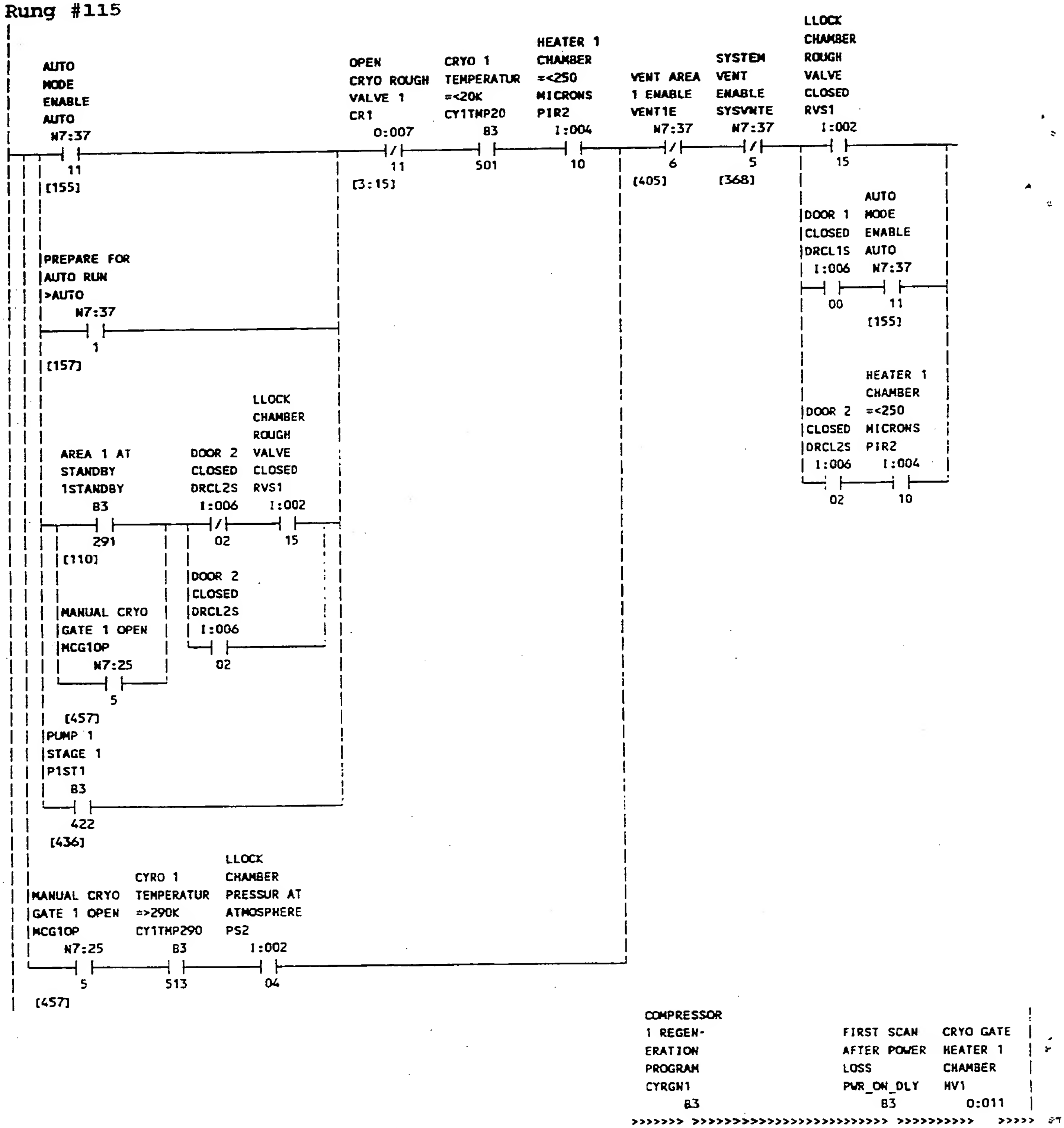
```
| SYSTEM                                                              AREA 3    |
| VENT                                                                AT STANDBY|
| ENABLE                                                              3STANDBY  |
| SYSVNTE                                                               B3      |
|  N7:37                                                                        |
|---] [---+-----------------------------------------------------------(U)-------|
|     5   |                                                            293      |
| [368]   |                                                                     |
|         | B3/293 - ] [ - File #2 MAIN_PRGRM - 125, 126, 127, 128, 129, 130    |
|         |          -(L)- - File #2 MAIN_PRGRM - 107                           |
|VENT AREA|                                                                     |
|3 ENABLE |                                                                     |
|VENT3E   |                                                                     |
|  N7:37  |                                                                     |
|---] [---|                                                                     |
|     8   |                                                                     |
|[418]    |                                                                     |
|PREPARE FOR                                                                    |
|AUTO RUN |                                                                     |
|>AUTO    |                                                                     |
|  N7:37  |                                                                     |
|---] [---|                                                                     |
|     1   |                                                                     |
|[157]    |                                                                     |
|reset    |                                                                     |
|RESET    |                                                                     |
| N7:17   |                                                                     |
|---] [---|                                                                     |
|    15   |                                                                     |
|[3]      |                                                                     |
|COMPRESSOR                                                                     |
|5 REGEN- |                                                                     |
|ERATION  |                                                                     |
|PROGRAM  |                                                                     |
|CYRGN5   |                                                                     |
|   B3    |                                                                     |
|---] [---|                                                                     |
|   325   |                                                                     |
|[3:46]   |                                                                     |
|COMPRESSOR                                                                     |
|6 REGEN- |                                                                     |
|ERATION  |                                                                     |
|PROGRAM  |                                                                     |
|CYRGN6   |                                                                     |
|   B3    |                                                                     |
|---] [---+                                                                     |
|   326                                                                         |
| [3:52]                                                                        |
```

```
Rung #113
| SYSTEM                                                                                    AREA 4      |
| VENT                                                                                      AT STANDBY  |
| ENABLE                                                                                    4STANDBY    |
| SYSVNTE                                                                                     B3        |
|   N7:37                                                                                             |
|-+----| |---+--------------------------------------------------------------------------------(U)-----|
| |     5    |                                                                               294      |
| | [368]    |                                                                                        |
| |          | B3/294 - -| |- - File #2 MAIN_PRGRM - 131, 132, 133, 134, 135, 136                     |
| |          |          -(L)- - File #2 MAIN_PRGRM - 108                                              |
| |VENT AREA |                                                                                        |
| |4 ENABLE  |                                                                                        |
| |VENT4E    |                                                                                        |
| |  N7:37   |                                                                                        |
| |----| |---|                                                                                        |
| |     9    |                                                                                        |
| |[425]     |                                                                                        |
| |PREPARE FOR                                                                                        |
| |AUTO RUN  |                                                                                        |
| |>AUTO     |                                                                                        |
| |   N7:37  |                                                                                        |
| |----| |---|                                                                                        |
| |     1    |                                                                                        |
| |[157]     |                                                                                        |
| |reset     |                                                                                        |
| |RESET     |                                                                                        |
| | N7:17    |                                                                                        |
| |--| |-----|                                                                                        |
| |  15      |                                                                                        |
| |[3]       |                                                                                        |
| |COMPRESSOR|                                                                                        |
| |7 REGEN-  |                                                                                        |
| |ERATION   |                                                                                        |
| |PROGRAM   |                                                                                        |
| |CYRGN7    |                                                                                        |
| |     B3   |                                                                                        |
| |----| |---|                                                                                        |
| |   327    |                                                                                        |
| |[3:57]    |                                                                                        |
| |COMPRESSOR|                                                                                        |
| |8 REGEN-  |                                                                                        |
| |ERATION   |                                                                                        |
| |PROGRAM   |                                                                                        |
| |CYRGN8    |                                                                                        |
| |     B3   |                                                                                        |
| +----| |---+                                                                                        |
|      328                                                                                            |
|    [3:63]                                                                                           |
```

Rung #114

```
| SYSTEM                                                                  |
| VENT                                                         AREA 5     |
| ENABLE                                                       AT STANDBY |
| SYSVNTE                                                      5STANDBY   |
|   N7:37                                                          B3     |
|-+--| |--+------------------------------------------------------(U)-----|
| |   5   |                                                        295    |
| |[368]  |                                                               |
| |       | B3/295 - -| |- - File #2 MAIN_PRGRM - 137, 138                 |
| |       |          -(L)- - File #2 MAIN_PRGRM - 109                       |
| |VENT AREA |                                                              |
| |5 ENABLE  |                                                              |
| |VENT5E    |                                                              |
| |  N7:37   |                                                              |
| |---| |----|                                                              |
| |    10    |                                                              |
| |[430]     |                                                              |
| |PREPARE FOR|                                                             |
| |AUTO RUN  |                                                              |
| |>AUTO     |                                                              |
| |   N7:37  |                                                              |
| |----| |---|                                                              |
| |     1    |                                                              |
| |[157]     |                                                              |
| |reset     |                                                              |
| |RESET     |                                                              |
| | N7:17    |                                                              |
| |-| |------|                                                              |
| |   15     |                                                              |
| |[3]       |                                                              |
| |COMPRESSOR|                                                              |
| |7 REGEN-  |                                                              |
| |ERATION   |                                                              |
| |PROGRAM   |                                                              |
| |CYRGN7    |                                                              |
| |    B3    |                                                              |
| +---| |----+                                                              |
|     327                                                                 |
|   [3:57]                                                                |
```

Rung #115


AUTO MODE ENABLE AUTO
N7:37
11
[155]
PREPARE FOR AUTO RUN >AUTO
N7:37
1
[157]
AREA 1 AT STANDBY 1STANDBY
B3
291
[110]
MANUAL CRYO GATE 1 OPEN MCG1OP
N7:25
5
[457]
PUMP 1 STAGE 1 P1ST1
B3
422
[436]
DOOR 2 CLOSED DRCL2S
I:006
02
LLOCK CHAMBER ROUGH VALVE CLOSED RVS1
I:002
15
DOOR 2 CLOSED DRCL2S
I:006
02
MANUAL CRYO GATE 1 OPEN MCG1OP
N7:25
5
[457]
CYRO 1 TEMPERATUR =>290K CY1TMP290
B3
513
LLOCK CHAMBER PRESSUR AT ATMOSPHERE PS2
I:002
04
OPEN CRYO ROUGH VALVE 1 CR1
O:007
11
[3:15]
CRYO 1 TEMPERATUR =<20K CY1TMP20
B3
501
HEATER 1 CHAMBER =<250 MICRONS PIR2
I:004
10
VENT AREA 1 ENABLE VENT1E
N7:37
6
[405]
SYSTEM VENT ENABLE SYSVNTE
N7:37
5
[368]
LLOCK CHAMBER ROUGH VALVE CLOSED RVS1
I:002
15
DOOR 1 CLOSED DRCL1S
I:006
00
AUTO MODE ENABLE AUTO
N7:37
11
[155]
DOOR 2 CLOSED DRCL2S
I:006
02
HEATER 1 CHAMBER =<250 MICRONS PIR2
I:004
10
COMPRESSOR 1 REGEN-ERATION PROGRAM CYRGN1
B3
FIRST SCAN AFTER POWER LOSS PWR_ON_DLY
B3
CRYO GATE HEATER 1 CHAMBER HV1
O:011
>>>>>>> >>>>>>>>>>>>>>>>>>>>>>>>>>> >>>>>>>>>> >>>>>

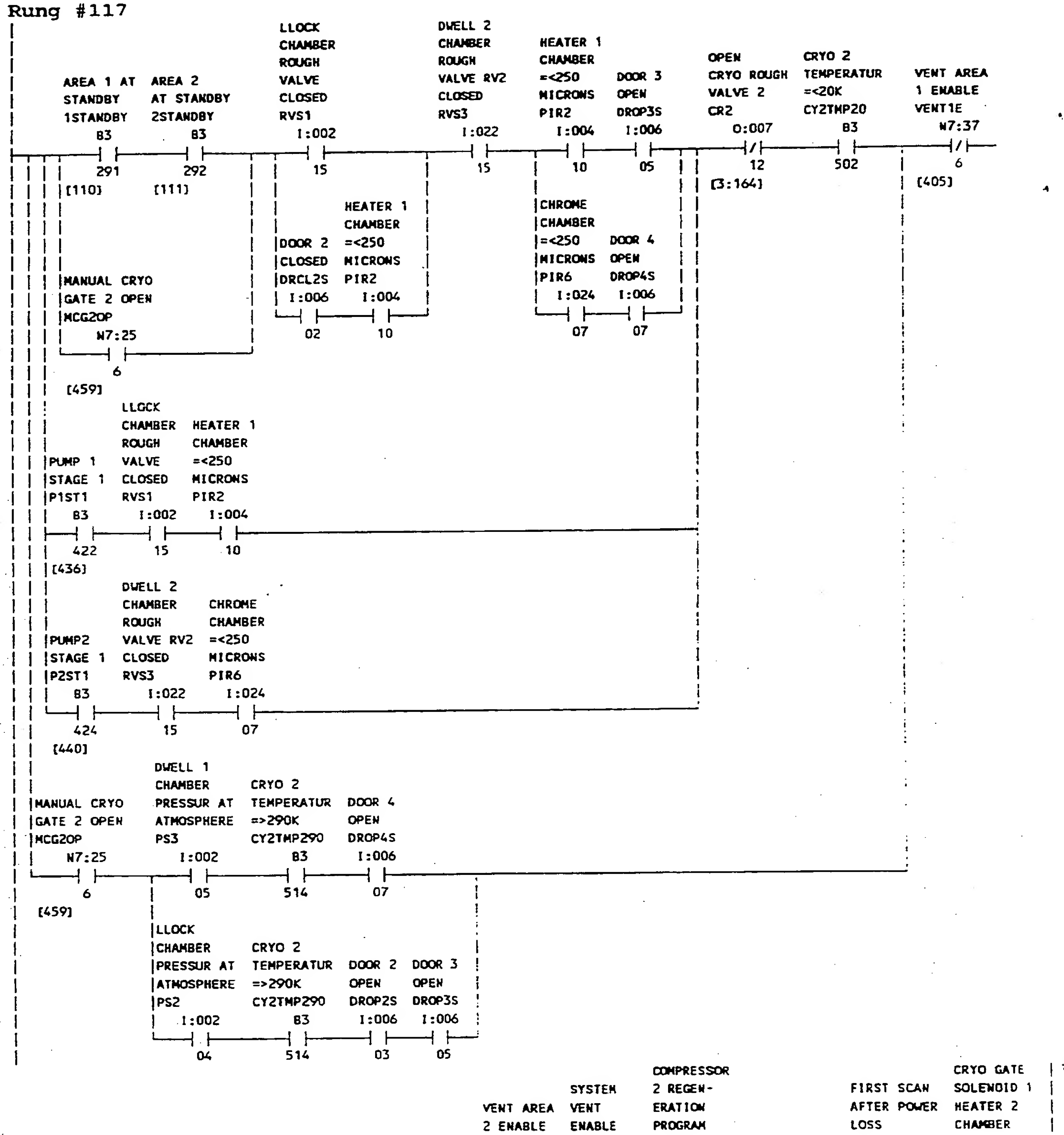
```
<<<<<<< <<<<<<   <<<<<<<<<<<<<<<<<< <<<<<<<<<<< <<<<<
-+---]/[---      ------+--------]/[----------( )---+
 |   321               |        444           11   |
 |[3:0]                | [1]                       |
 |COMPRESSOR           |                           |
 |1 REGEN-             |                           |
 |ERATION     COOL DOWN|                           |
 |PROGRAM     1        |                           |
 |CYRGN1      CD1      |                           |
 |    B3         B3    |                           |
 +---] [---------] [---+                           |
     321         651                               |
    [3:0]       [3:20]                             |
```

```
0:011/11 - ] [ - File #5 FAULTS -  69
                 File #6 TECH_RUNGS -  6
           ]/[ - File #5 FAULTS -  117
           ( ) - File #2 MAIN_PRGRM -  115
```

Rung #116

```
| DOOR 3                                                         HEATER 1     |
| CLOSED                                                         HIVAC BAFFLE |
| DRCL3S                                                         HV1_2        |
|  I:006                                                           O:011      |
+-+--] [--+---------------------------------------------------------(U)-------+
| |   04  |                                                           12      |
| |       | O:011/12 - ] [ - File #2 MAIN_PRGRM - 379
| |AUTO   |            ]/[ - File #2 MAIN_PRGRM - 38
| |MODE   |            (L) - File #2 MAIN_PRGRM - 215
| |ENABLE |
| |AUTO   |
| | N7:37 |
| +--]/[--+
|     11
|  [155]
```

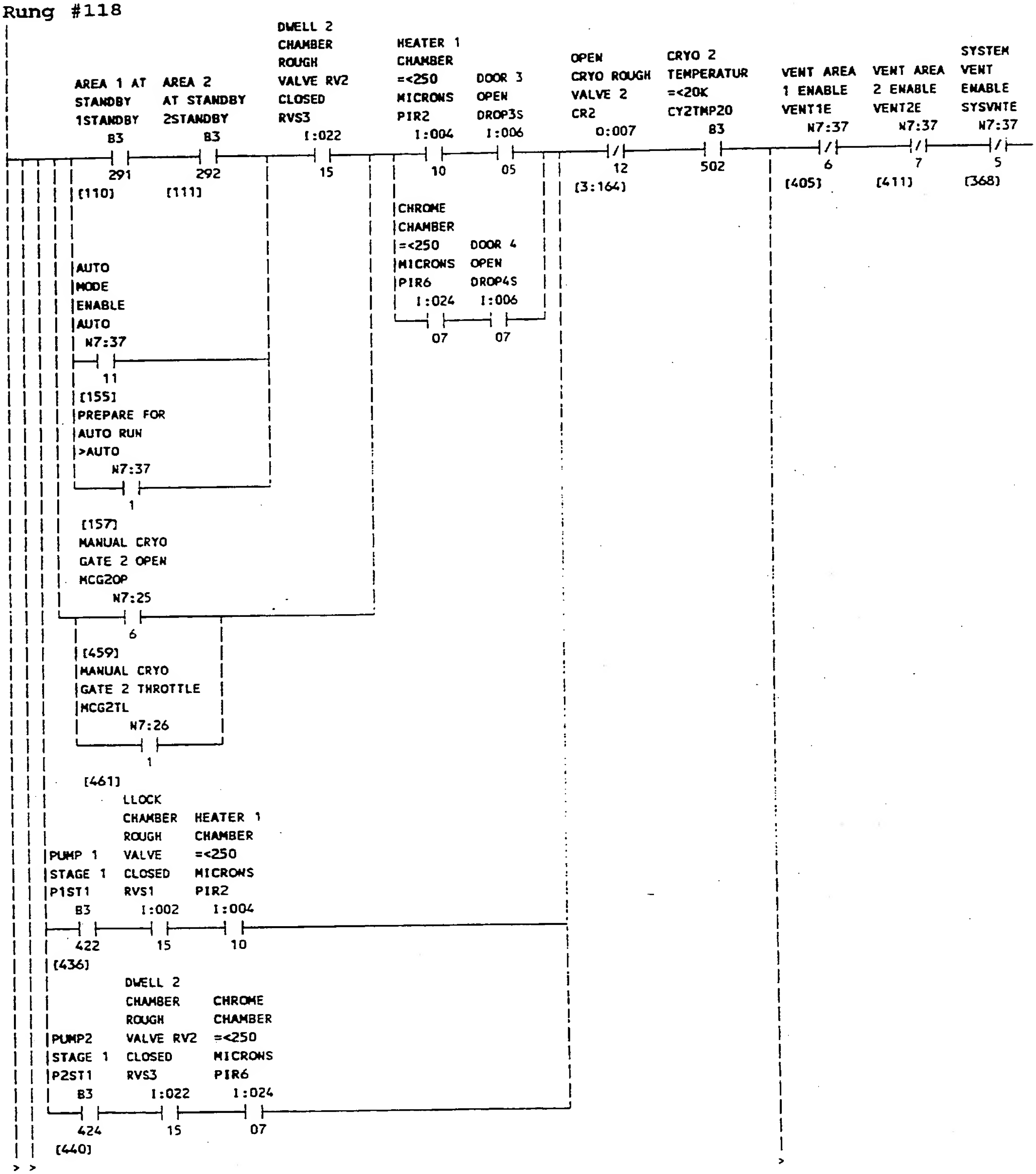
Rung #117

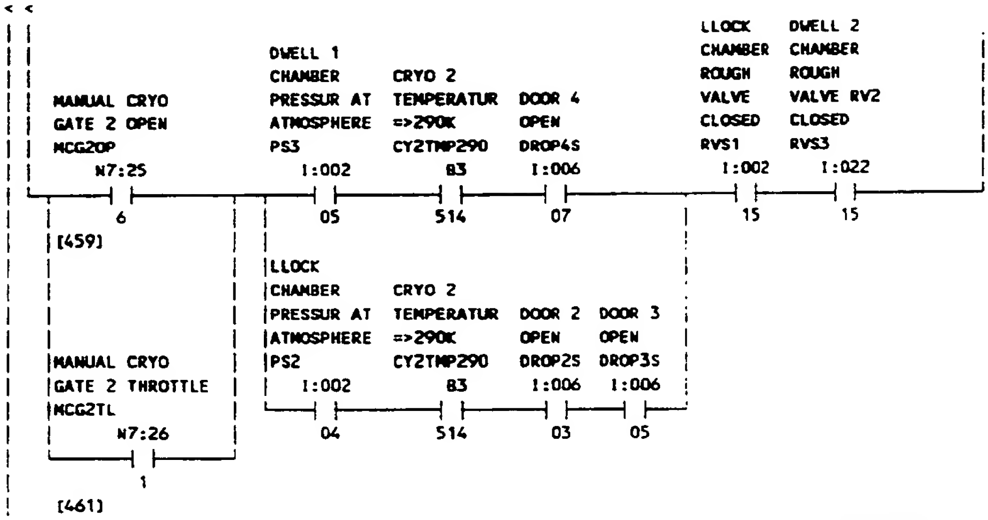

AREA 1 AT STANDBY 1STANDBY B3 291 [110]
AREA 2 AT STANDBY 2STANDBY B3 292 [111]
LLOCK CHAMBER ROUGH VALVE CLOSED RVS1 I:002 15
DWELL 2 CHAMBER ROUGH VALVE RV2 CLOSED RVS3 I:022 15
HEATER 1 CHAMBER =<250 MICRONS PIR2 I:004 10
DOOR 3 OPEN DROP3S I:006 05
OPEN CRYO ROUGH VALVE 2 CR2 O:007 12 [3:164]
CRYO 2 TEMPERATUR =<20K CY2TMP20 B3 502
VENT AREA 1 ENABLE VENT1E N7:37 6 [405]
DOOR 2 CLOSED DRCL2S I:006 02
HEATER 1 CHAMBER =<250 MICRONS PIR2 I:004 10
CHROME CHAMBER =<250 MICRONS PIR6 I:024 07
DOOR 4 OPEN DROP4S I:006 07
MANUAL CRYO GATE 2 OPEN MCG2OP N7:25 6 [459]
PUMP 1 STAGE 1 P1ST1 B3 422 [436]
LLOCK CHAMBER ROUGH VALVE CLOSED RVS1 I:002 15
HEATER 1 CHAMBER =<250 MICRONS PIR2 I:004 10
PUMP2 STAGE 1 P2ST1 B3 424 [440]
DWELL 2 CHAMBER ROUGH VALVE RV2 CLOSED RVS3 I:022 15
CHROME CHAMBER =<250 MICRONS PIR6 I:024 07
MANUAL CRYO GATE 2 OPEN MCG2OP N7:25 6 [459]
DWELL 1 CHAMBER PRESSUR AT ATMOSPHERE PS3 I:002 05
CRYO 2 TEMPERATUR =>290K CY2TMP290 B3 514
DOOR 4 OPEN DROP4S I:006 07
LLOCK CHAMBER PRESSUR AT ATMOSPHERE PS2 I:002 04
CRYO 2 TEMPERATUR =>290K CY2TMP290 B3 514
DOOR 2 OPEN DROP2S I:006 03
DOOR 3 OPEN DROP3S I:006 05
VENT AREA 2 ENABLE
SYSTEM VENT ENABLE
COMPRESSOR 2 REGEN-ERATION PROGRAM
FIRST SCAN AFTER POWER LOSS
CRYO GATE SOLENOID 1 HEATER 2 CHAMBER

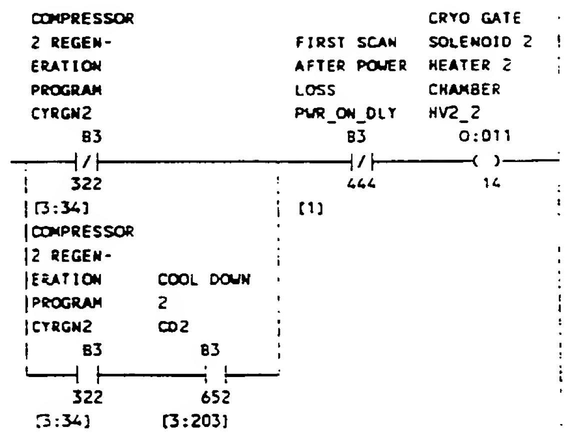
```
VENTZE      SYSVNTE     CYRGN2                          PWR_ON_DLY   HV2_1
 N7:37       N7:37        B3                                B3       O:011
---|/|--------|/|--------+--|/|--------------------+--------|/|--------( )---
    7           5        |  322                     |       444         13
 [411]       [368]       |[3:34]                    | [1]
                         |COMPRESSOR                |
                         |2 REGEN-                  |
                         |ERATION      COOL DOWN    |
                         |PROGRAM      2            |
                         |CYRGN2       CD2          |
                         |   B3           B3        |
                         +--| |-----------| |-------+
                            322           652
                          [3:34]        [3:203]

O:011/13 - -| |- - File #5 FAULTS -  71
                   File #6 TECH_RUNGS -  6
           -|/|- - File #5 FAULTS -  94,119
           -( )- - File #2 MAIN_PRGRM -  117
```

Rung #118

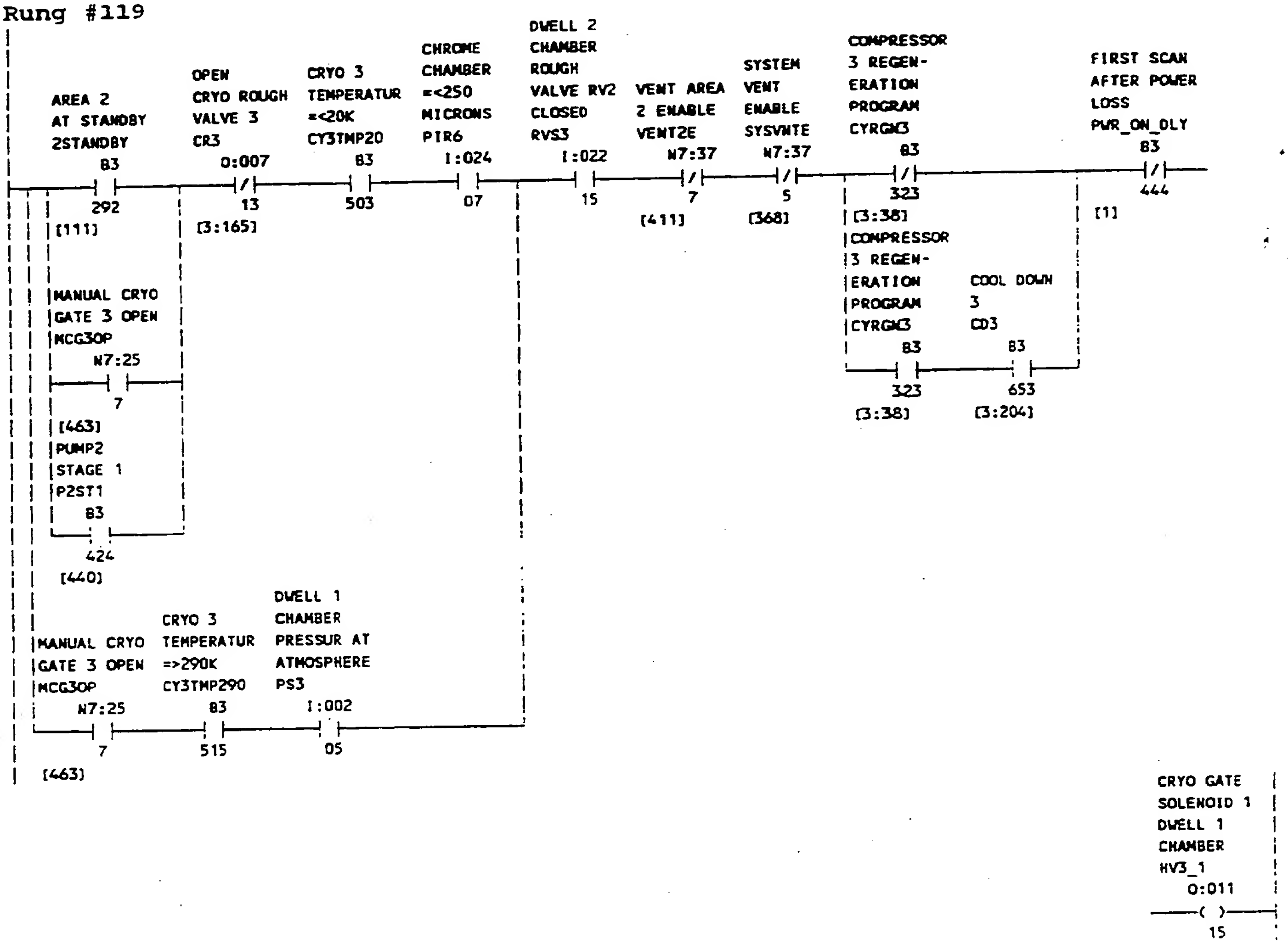

AREA 1 AT STANDBY 1STANDBY B3 291 [110]
AREA 2 AT STANDBY 2STANDBY B3 292 [111]
DWELL 2 CHAMBER ROUGH VALVE RV2 CLOSED RVS3 I:022 15
HEATER 1 CHAMBER =<250 MICRONS PIR2 I:004 10
DOOR 3 OPEN DROP3S I:006 05
OPEN CRYO ROUGH VALVE 2 CR2 O:007 12 [3:164]
CRYO 2 TEMPERATUR =<20K CY2TMP20 B3 502
VENT AREA 1 ENABLE VENT1E N7:37 6 [405]
VENT AREA 2 ENABLE VENT2E N7:37 7 [411]
SYSTEM VENT ENABLE SYSVNTE N7:37 5 [368]
CHROME CHAMBER =<250 MICRONS PIR6 I:024 07
DOOR 4 OPEN DROP4S I:006 07
AUTO MODE ENABLE AUTO N7:37 11 [155]
PREPARE FOR AUTO RUN >AUTO N7:37 1
[157] MANUAL CRYO GATE 2 OPEN MCG2OP N7:25 6
[459] MANUAL CRYO GATE 2 THROTTLE MCG2TL N7:26 1
[461]
PUMP 1 STAGE 1 P1ST1 B3 422 [436]
LLOCK CHAMBER ROUGH VALVE CLOSED RVS1 I:002 15
HEATER 1 CHAMBER =<250 MICRONS PIR2 I:004 10
PUMP2 STAGE 1 P2ST1 B3 424 [440]
DWELL 2 CHAMBER ROUGH VALVE RV2 CLOSED RVS3 I:022 15
CHROME CHAMBER =<250 MICRONS PIR6 I:024 07
> >
>





O:011/14 - ┤ ├ - File #5 FAULTS - 71,94
File #6 TECH_RUNGS - 6
┤/├ - File #5 FAULTS - 119
-( )- - File #2 MAIN_PRGRM - 118

Rung #119



O:011/15 - ┤ ├ - - File #5 FAULTS - 73
File #6 TECH_RUNGS - 6
┤/├ - File #5 FAULTS - 96,121
-( )- - File #2 MAIN_PRGRM - 119

Rung #120

AREA 2 AT STANDBY 2STANDBY B3 292 [111]

OPEN CRYO ROUGH VALVE 3 CR3 O:007 13 [3:165]

CRYO 3 TEMPERATUR =<20K CY3TMP20 B3 503

CHROME CHAMBER =<250 MICRONS PIR6 I:024 07

DWELL 2 CHAMBER ROUGH VALVE RV2 CLOSED RVS3 I:022 15

VENT AREA 2 ENABLE VENT2E N7:37 7 [411]

SYSTEM VENT ENABLE SYSVNTE N7:37 5 [368]

COMPRESSOR 3 REGEN-ERATION PROGRAM CYRGN3 B3 323 [3:38]

FIRST SCAN AFTER POWER LOSS PWR_ON_DLY B3 444 [1]

COOL DOWN 3 CD3 B3 653 [3:204]

COMPRESSOR 3 REGEN-ERATION PROGRAM CYRGN3 B3 323 [3:38]

MANUAL CRYO GATE 3 OPEN MCG3OP N7:25 7 [463]

MANUAL CRYO GATE 3 THROTTLE MCG3TL N7:26 2 [465]

PUMP2 STAGE 1 P2ST1 B3 424 [440]

MANUAL CONTROL CRYO GATE 3 THROTTLE M-HV3-2 N7:5 2 [3]

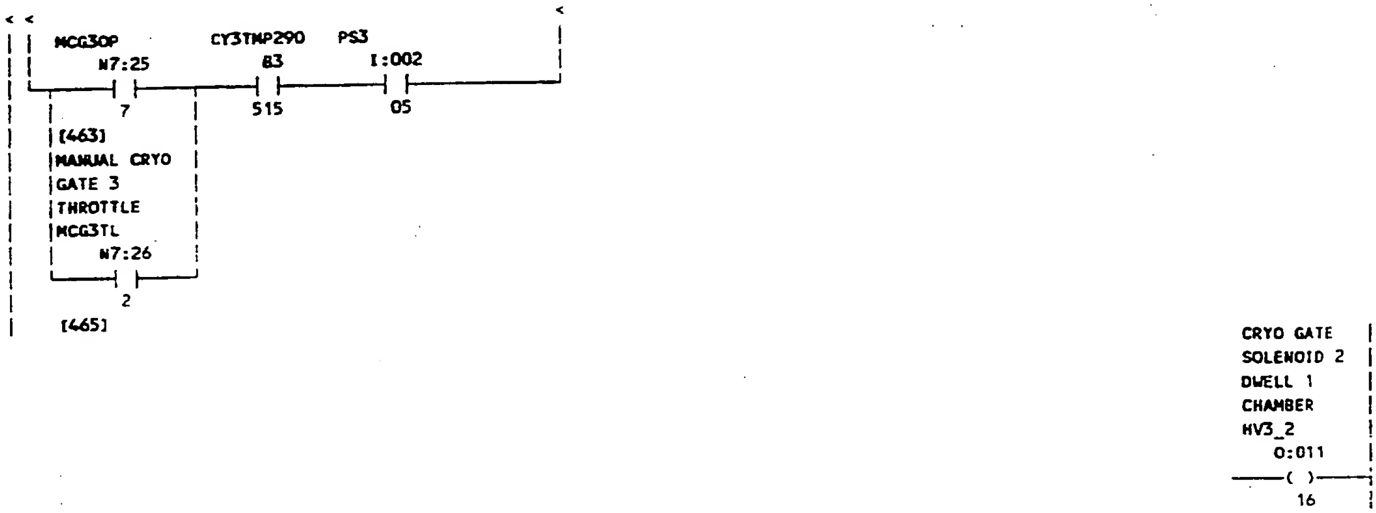
PREPARE FOR AUTO RUN >AUTO N7:37 1 [157]

AUTO MODE ENABLE AUTO N7:37 11 [155]

MANUAL CRYO GATE 3 OPEN

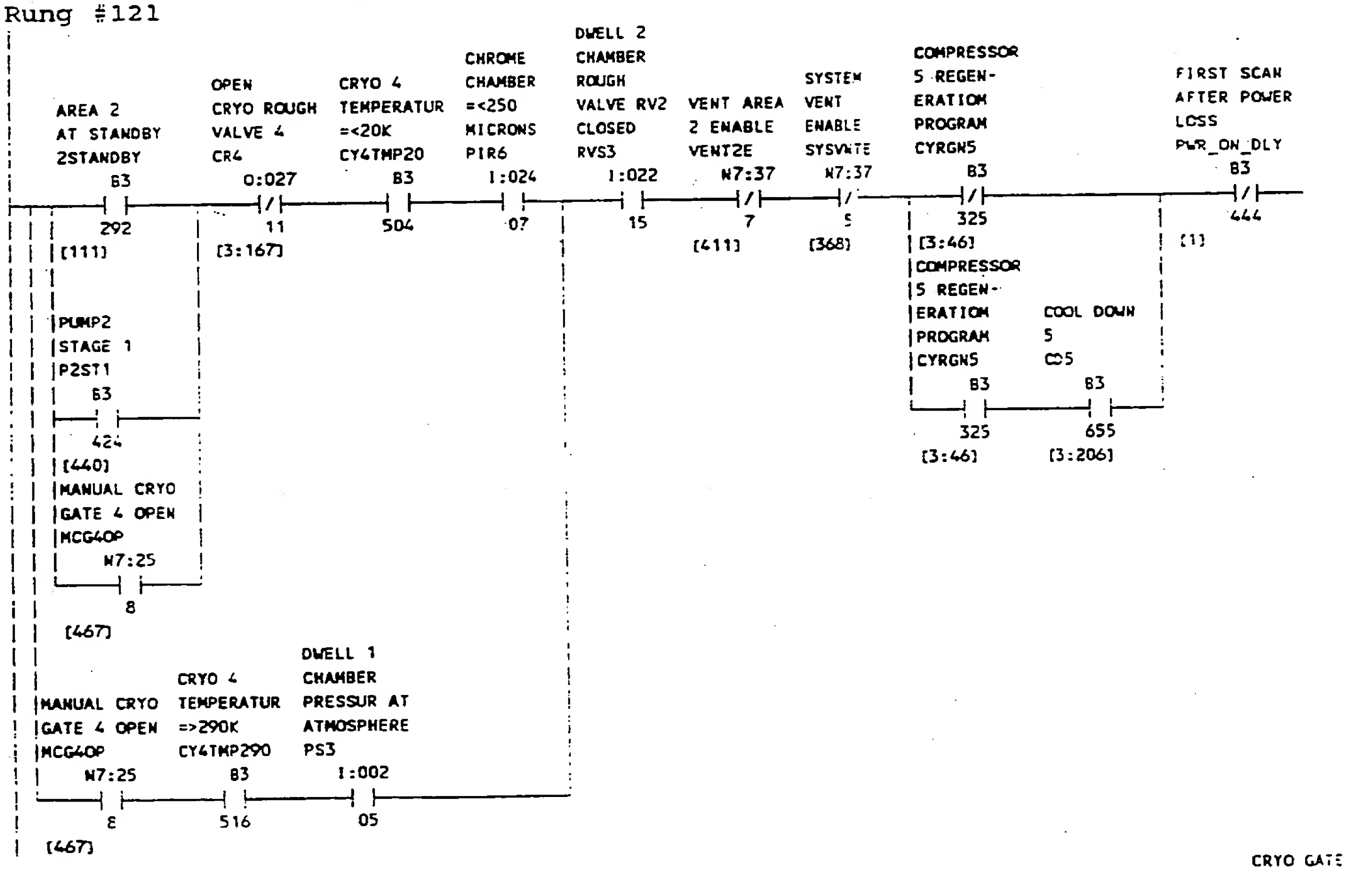
CRYO 3 TEMPERATUR =>290K

DWELL 1 CHAMBER PRESSUR AT ATMOSPHERE



O:011/16 - ┤ ├ - File #5 FAULTS - 73,96
File #6 TECH_RUNGS - 6
┤/├ - File #5 FAULTS - 121
-( )- - File #2 MAIN_PRGRM - 120

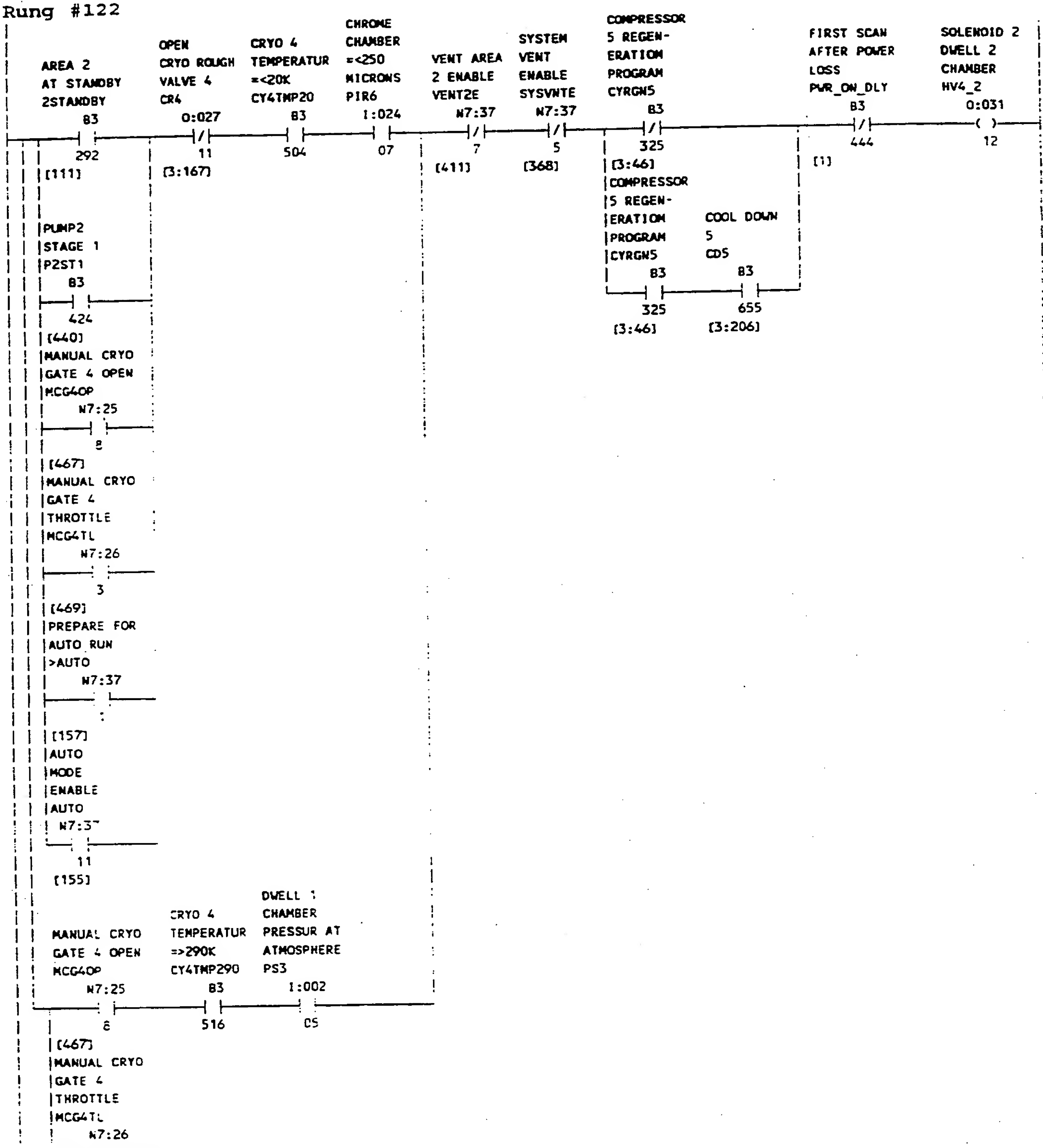
Rung #121



```
                                                                 SOLENOID 1  |
                                                                 DWELL 2     |
                                                                 CHAMBER     |
                                                                 HV4_1       |
                                                                   O:031     |
                                                               ------( )-----|
                                                                    11       |

O:031/11 - -| |- - File #5 FAULTS -  75
                   File #6 TECH_RUNGS -  6
           -|/|- - File #5 FAULTS -  98,123
           -( )- - File #2 MAIN_PRGRM -  121
```

Rung #122


AREA 2
AT STANDBY
2STANDBY
B3
292
[111]
OPEN
CRYO ROUGH
VALVE 4
CR4
O:027
11
[3:167]
CRYO 4
TEMPERATUR
=<20K
CY4TMP20
B3
504
CHROME
CHAMBER
=<250
MICRONS
PIR6
I:024
07
VENT AREA
2 ENABLE
VENT2E
N7:37
7
[411]
SYSTEM
VENT
ENABLE
SYSVNTE
N7:37
5
[368]
COMPRESSOR
5 REGEN-
ERATION
PROGRAM
CYRGN5
B3
325
[3:46]
FIRST SCAN
AFTER POWER
LOSS
PWR_ON_DLY
B3
444
[1]
SOLENOID 2
DWELL 2
CHAMBER
HV4_2
O:031
12
PUMP2
STAGE 1
P2ST1
B3
424
[440]
MANUAL CRYO
GATE 4 OPEN
MCG4OP
N7:25
8
[467]
MANUAL CRYO
GATE 4
THROTTLE
MCG4TL
N7:26
3
[469]
PREPARE FOR
AUTO RUN
>AUTO
N7:37
[157]
AUTO
MODE
ENABLE
AUTO
N7:37
11
[155]
COMPRESSOR
5 REGEN-
ERATION
PROGRAM
CYRGN5
B3
325
[3:46]
COOL DOWN
5
CD5
B3
655
[3:206]
MANUAL CRYO
GATE 4 OPEN
MCG4OP
N7:25
8
CRYO 4
TEMPERATUR
=>290K
CY4TMP290
B3
516
DWELL 1
CHAMBER
PRESSUR AT
ATMOSPHERE
PS3
I:002
05
[467]
MANUAL CRYO
GATE 4
THROTTLE
MCG4TL
N7:26
>>>>>>> >>>>>>>

```
<  <<<<<<< <<<<<<<
|  |----| |----|
|        3
|  [469]
0:031/12 - -| |- - File #5 FAULTS -  75,98
                    File #6 TECH_RUNGS -  6
          -|/|- - File #5 FAULTS -  123
          -( )- - File #2 MAIN_PRGRM -  122
```

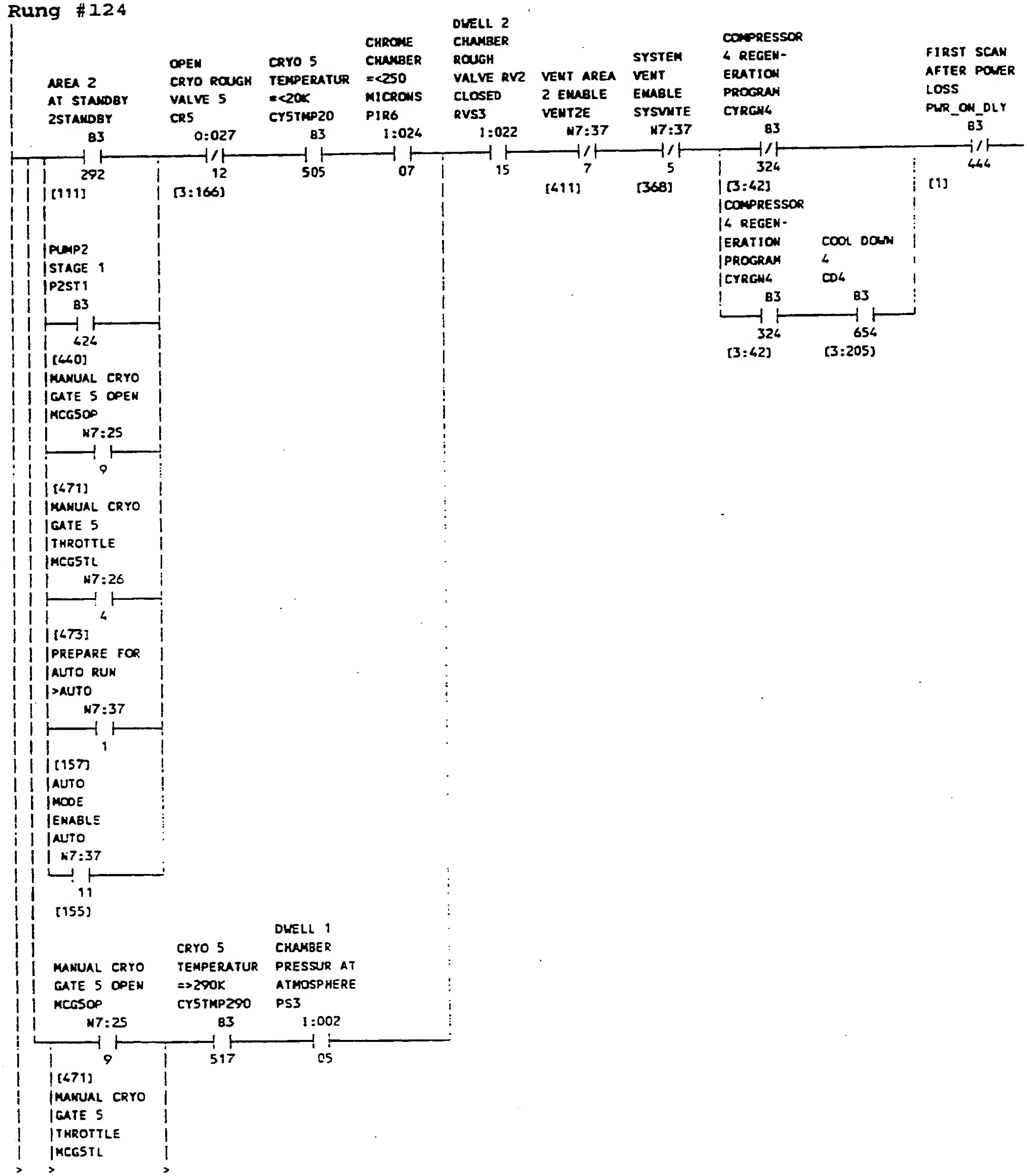
Rung #123

```
AREA 2 AT STANDBY 2STANDBY B3 -| |- 292 [111]
  OR PUMP2 STAGE 1 P2ST1 B3 -| |- 424 [440]
  OR MANUAL CRYO GATE 5 OPEN MCG5OP N7:25 -| |- 9 [471]
OPEN CRYO ROUGH VALVE 5 CR5 O:027 -|/|- 12 [3:166]
CRYO 5 TEMPERATUR =<20K CY5TMP20 B3 -| |- 505
CHROME CHAMBER =<250 MICRONS PIR6 I:024 -| |- 07
  OR MANUAL CRYO GATE 5 OPEN MCG5OP N7:25 -| |- 9 [471]
     CRYO 5 TEMPERATUR =>290K CY5TMP290 B3 -| |- 517
     DWELL 1 CHAMBER PRESSUR AT ATMOSPHERE PS3 I:002 -| |- 05
DWELL 2 CHAMBER ROUGH VALVE RV2 CLOSED RVS3 I:022 -| |- 15
VENT AREA 2 ENABLE VENT2E N7:37 -|/|- 7 [411]
SYSTEM VENT ENABLE SYSVNTE N7:37 -|/|- 5 [368]
COMPRESSOR 4 REGEN-ERATION PROGRAM CYRGN4 B3 -|/|- 324 [3:42]
  OR COMPRESSOR 4 REGEN-ERATION PROGRAM CYRGN4 B3 -| |- 324 [3:42]
     COOL DOWN 4 CD4 B3 -| |- 654 [3:205]
FIRST SCAN AFTER POWER LOSS PWR_ON_DLY B3 -|/|- 444 [1]

CRYO GATE SOLENOID 1 HEATER 2 CHAMBER HV5_1 O:031 -( )- 13
```

```
0:031/13 - -| |- - File #5 FAULTS -  77
                    File #6 TECH_RUNGS -  6
          -|/|- - File #5 FAULTS -  100,125
          -( )- - File #2 MAIN_PRGRM -  123
```

Rung #124


AREA 2 AT STANDBY 2STANDBY B3 292 [111]
OPEN CRYO ROUGH VALVE 5 CR5 O:027 12 [3:166]
CRYO 5 TEMPERATUR =<20K CY5TMP20 B3 505
CHROME CHAMBER =<250 MICRONS PIR6 I:024 07
DWELL 2 CHAMBER ROUGH VALVE RV2 CLOSED RVS3 I:022 15
VENT AREA 2 ENABLE VENT2E N7:37 7 [411]
SYSTEM VENT ENABLE SYSVNTE N7:37 5 [368]
COMPRESSOR 4 REGEN-ERATION PROGRAM CYRGN4 B3 324 [3:42]
COMPRESSOR 4 REGEN-ERATION PROGRAM CYRGN4 B3 324 [3:42]
COOL DOWN 4 CD4 B3 654 [3:205]
FIRST SCAN AFTER POWER LOSS PWR_ON_DLY B3 444 [1]
PUMP2 STAGE 1 P2ST1 B3 424 [440]
MANUAL CRYO GATE 5 OPEN MCG5OP N7:25 9 [471]
MANUAL CRYO GATE 5 THROTTLE MCG5TL N7:26 4 [473]
PREPARE FOR AUTO RUN >AUTO N7:37 1 [157]
AUTO MODE ENABLE AUTO N7:37 11 [155]
MANUAL CRYO GATE 5 OPEN MCG5OP N7:25 9 [471]
CRYO 5 TEMPERATUR =>290K CY5TMP290 B3 517
DWELL 1 CHAMBER PRESSUR AT ATMOSPHERE PS3 I:002 05
MANUAL CRYO GATE 5 THROTTLE MCG5TL

N7:26
4
[473]

CRYO GATE SOLENOID 2 HEATER 2 CHAMBER
HV5_2
O:031
( )
14

O:031/14 - -] [- - File #5 FAULTS - 77,100
File #6 TECH_RUNGS - 6
-]/[- - File #5 FAULTS - 125
-( )- - File #2 MAIN_PRGRM - 124

Rung #125

AREA 3 AT STANDBY 3STANDBY B3 293 [112]
OPEN CRYO ROUGH VALVE 6 CR6 O:027 13 [3:168]
CRYO 6 TEMPERATUR =<20K CY6TMP20 B3 506
MAGNETIC CHAMBER =<250 MICRONS PIR11 I:040 07
DWELL 4 CHAMBER ROUGH VALVE CLOSED RVS5 I:036 15
VENT AREA 3 ENABLE VENT3E N7:37 8 [418]
SYSTEM VENT ENABLE SYSVNTE N7:37 5 [368]
COMPRESSOR 5 REGEN-ERATION PROGRAM CYRGN5 B3 325 [3:46]
FIRST SCAN AFTER POWER LOSS PWR_ON_DLY B3 444 [1]

PUMP 3 STAGE 1 P3ST1 B3 426 [444]

COMPRESSOR 5 REGEN-ERATION PROGRAM CYRGN5 B3 325 [3:46]
COOL DOWN 5 CD5 B3 655 [3:206]

MANUAL CRYO GATE 6 OPEN MCG6OP N7:25 10 [475]

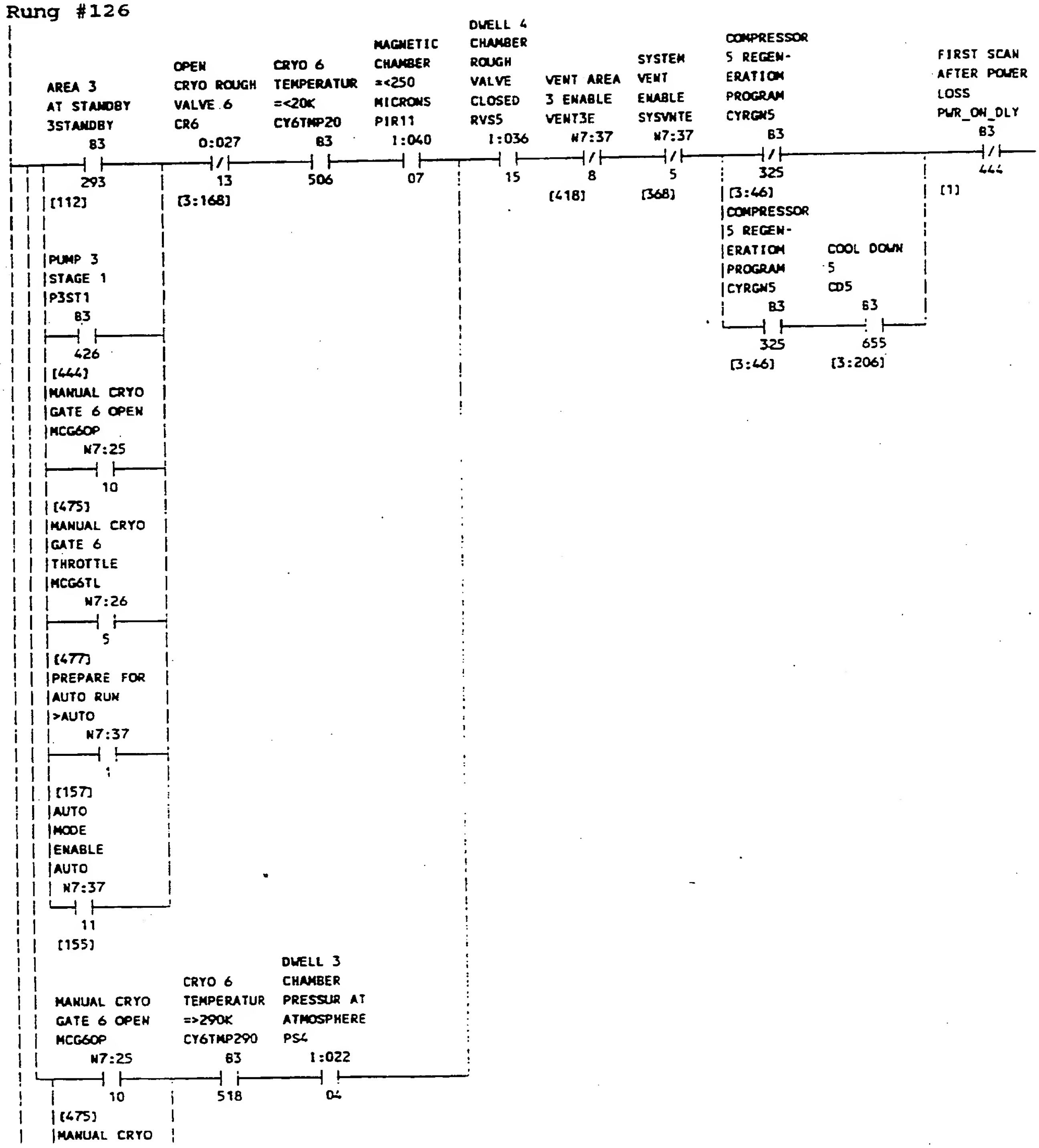
MANUAL CRYO GATE 6 OPEN MCG6OP N7:25 10 [475]
CRYO 6 TEMPERATUR =>290K CY6TMP290 B3 518
DWELL 3 CHAMBER PRESSUR AT ATMOSPHERE PS4 I:022 04

CRYO GATE SOLENOID 1 DWELL 3 CHAMBER
HV6_1
O:031
( )
15

O:031/15 - -] [- - File #5 FAULTS - 79

File #6 TECH_RUNG' 6
—|/|— - File #5 FAULTS - 127
—( )— - File #2 MAIN_PRGRM - 125

Rung #126



GATE 6
THROTTLE
MCG6TL
N7:26
5
[477]

CRYO GATE
SOLENOID 2
DWELL 3
CHAMBER
HV6_2
O:031
( )
16

O:031/16 - -| |- - File #5 FAULTS - 79,102
File #6 TECH_RUNGS - 6
-|/|- - File #5 FAULTS - 127
-( )- - File #2 MAIN_PRGRM - 126

Rung #127

AREA 3 AT STANDBY 3STANDBY B3 293 [112]
OPEN CRYO ROUGH VALVE 7 CR7 O:043 -|/|- 11 [3:169]
CRYO 7 TEMPERATUR =<20K CY7TMP20 B3 507
MAGNETIC CHAMBER =<250 MICRONS PIR11 I:040 07
DWELL 4 CHAMBER ROUGH VALVE CLOSED RVS5 I:036 15
VENT AREA 3 ENABLE VENT3E N7:37 -|/|- 8 [418]
SYSTEM VENT ENABLE SYSVNTE N7:37 -|/|- 5 [368]
COMPRESSOR 5 REGEN- ERATION PROGRAM CYRGN5 B3 -|/|- 325 [3:46]
FIRST SCAN AFTER POWER LOSS PWR_ON_DLY B3 -|/|- 444 [1]

PUMP 3 STAGE 1 P3ST1 B3 426 [444]
MANUAL CRYO GATE 7 OPEN MCG7OP N7:25 11 [479]

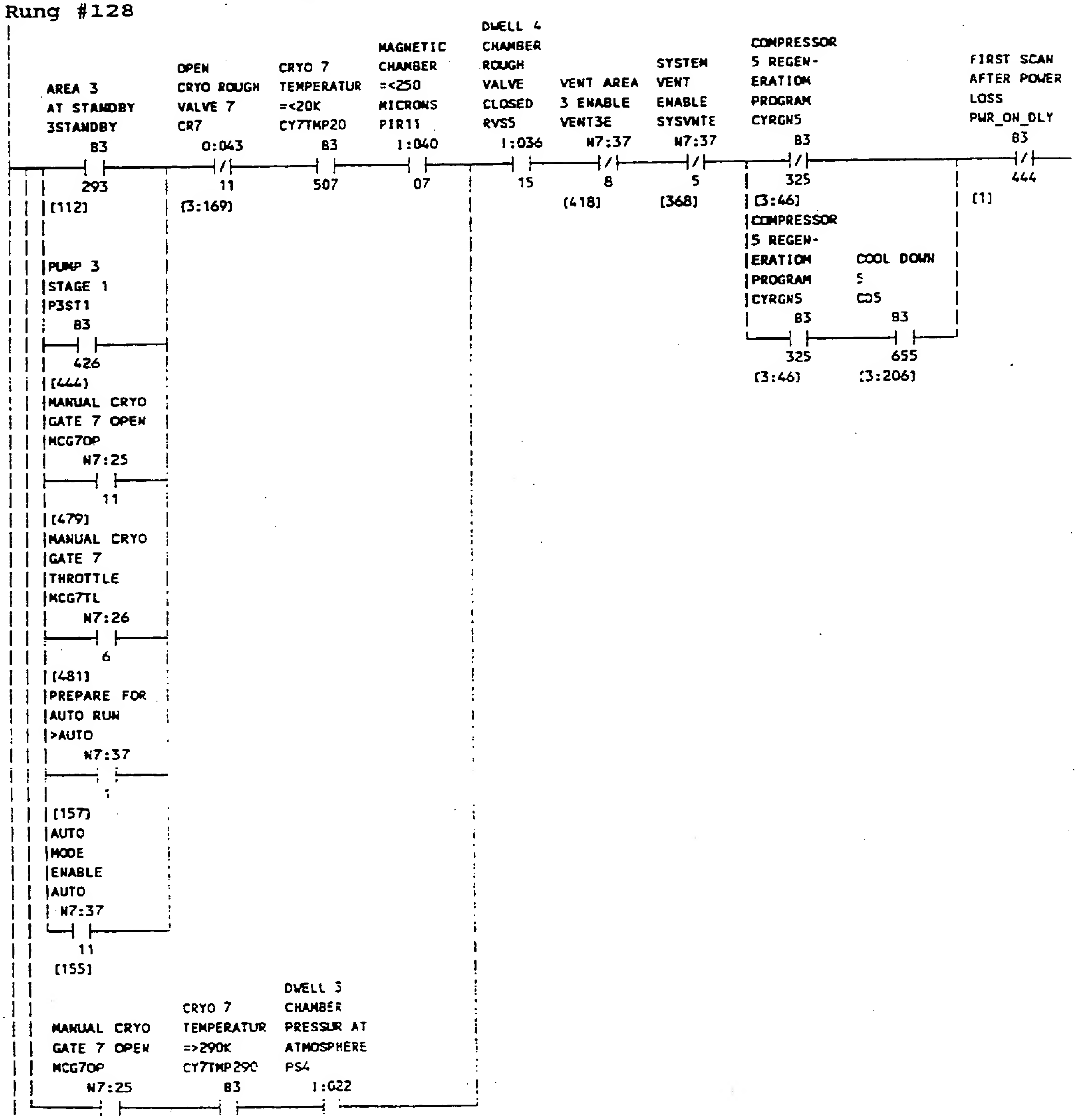
COMPRESSOR 5 REGEN- ERATION PROGRAM CYRGN5 B3 325 [3:46]
COOL DOWN 5 CD5 B3 655 [3:206]

MANUAL CRYO GATE 7 OPEN MCG7OP N7:25 11 [479]
CRYO 7 TEMPERATUR =>290K CY7TMP290 B3 519
DWELL 3 CHAMBER PRESSUR AT ATMOSPHERE PS4 I:022 04

CRYO GATE
SOLENOID 1
DWELL 4
CHAMBER
HV7_1
O:045
( )

0:045/11 - ┤ ├ - File #5 FAULTS - 81
File #6 TECH_RUNGS - 6
┤/├ - File #5 FAULTS - 104,129
┤)- - File #2 MAIN_PRGRM - 127

Rung #128



11 519
[479]
MANUAL CRYO GATE 7 THROTTLE
MCG7TL
N7:26
6
[481]

CRYO GATE SOLENOID 2 DWELL 4 CHAMBER
HV7_2
0:045
12

0:045/12 - -| |- - File #5 FAULTS - 81,104
File #6 TECH_RUNGS - 7
-|/|- - File #5 FAULTS - 129
-( )- - File #2 MAIN_PRGRM - 128

Rung #129

AREA 3 AT STANDBY
3STANDBY
B3
293
[112]

OPEN CRYO ROUGH VALVE 8
CR8
0:043
12
[3:170]

CRYO 8 TEMPERATUR =<20K
CY8TMP20
B3
508

MAGNETIC CHAMBER =<250 MICRONS
PIR11
I:040
07

DWELL 4 CHAMBER ROUGH VALVE CLOSED
RVS5
I:036
15

VENT AREA 3 ENABLE
VENT3E
N7:37
8
[418]

SYSTEM VENT ENABLE
SYSVNTE
N7:37
5
[368]

COMPRESSOR 6 REGEN-ERATION PROGRAM
CYRGN6
B3
326
[3:52]

FIRST SCAN AFTER POWER LOSS
PWR_ON_DLY
B3
444

PUMP 3 STAGE 1
P3ST1
B3
426
[444]

MANUAL CRYO GATE 8 OPEN
MCG8OP
N7:25
12
[483]

COMPRESSOR 6 REGEN-ERATION PROGRAM
CYRGN6
B3
326
[3:52]

COOL DOWN 6
CD6
B3
656
[3:207]

MANUAL CRYO GATE 8 OPEN
MCG8OP
N7:25
12
[483]

CRYO 8 TEMPERATUR =>290K
CY8TMP290
B3
520

DWELL 3 CHAMBER PRESSUR AT ATMOSPHERE
PS4
I:022
04

CRYO GATE SOLENOID 1 BUFFER 3 CHAMBER

HV8_1
0:045
—( )—
13

0:045/13 - ┤ ├ - - File #5 FAULTS - 83
File #6 TECH_RUNGS - 7
┤/├ - - File #5 FAULTS - 106,131
-( )- - - File #2 MAIN_PRGRM - 129

Rung #130

AREA 3 AT STANDBY 3STANDBY B3 ┤ ├ 293 [112]

OPEN CRYO ROUGH VALVE 8 CR8 0:043 ┤/├ 12 [3:170]

CRYO 8 TEMPERATUR =<20K CY8TMP20 B3 ┤ ├ 508

MAGNETIC CHAMBER =<250 MICRONS PIR11 I:040 ┤ ├ 07

DWELL 4 CHAMBER ROUGH VALVE CLOSED RVS5 I:036 ┤ ├ 15

VENT AREA 3 ENABLE VENT3E N7:37 ┤/├ 8 [418]

SYSTEM VENT ENABLE SYSVNTE N7:37 ┤/├ 5 [368]

COMPRESSOR 6 REGEN-ERATION PROGRAM CYRGN6 B3 ┤/├ 326 [3:52]

FIRST SCAN AFTER POWER LOSS PWR_ON_DLY B3 ┤/├ 444 [1]

COMPRESSOR 6 REGEN-ERATION PROGRAM CYRGN6 B3 ┤ ├ 326 [3:52]

COOL DOWN 6 CD6 B3 ┤ ├ 656 [3:207]

PUMP 3 STAGE 1 P3ST1 B3 ┤ ├ 426 [444]

MANUAL CRYO GATE 8 OPEN MCG8OP N7:25 ┤ ├ 12 [483]

MANUAL CRYO GATE 8 THROTTLE MCG8TL N7:26 ┤ ├ 7 [485]

PREPARE FOR AUTO RUN >AUTO N7:37 ┤ ├ 1 [157]

AUTO MODE ENABLE AUTO N7:37 ┤ ├ 11 [155]

MANUAL CRYO GATE 8 OPEN

CRYO 8 TEMPERATUR =>290K

DWELL 3 CHAMBER PRESSUR AT ATMOSPHERE

```
< <                                                   <
| | MCG8OP          CY8TMP290   PS4                   |
| |    N7:25          B3       I:022                  |
| L-----| |-----+-----| |-------| |-------------------+
|   |    12     |    520        04
|   |[483]      |
|   |MANUAL CRYO|
|   |GATE 8     |
|   |THROTTLE   |
|   |MCG8TL     |
|   |    N7:26  |
|   L-----| |---+
|          7
|   [485]
                                                                          CRYO GATE     |
                                                                          SOLENOID 2    |
                                                                          BUFFER 3      |
                                                                          CHAMBER       |
                                                                          HV8_2         |
                                                                            O:045       |
                                                                          ----( )-------+
                                                                              14        |

O:045/14 - -| |- - File #5 FAULTS -  83,106
                    File #6 TECH_RUNGS -  7
           -|/|- - File #5 FAULTS -  131
           -( )- - File #2 MAIN_PRGRM -  130
```

Rung #131

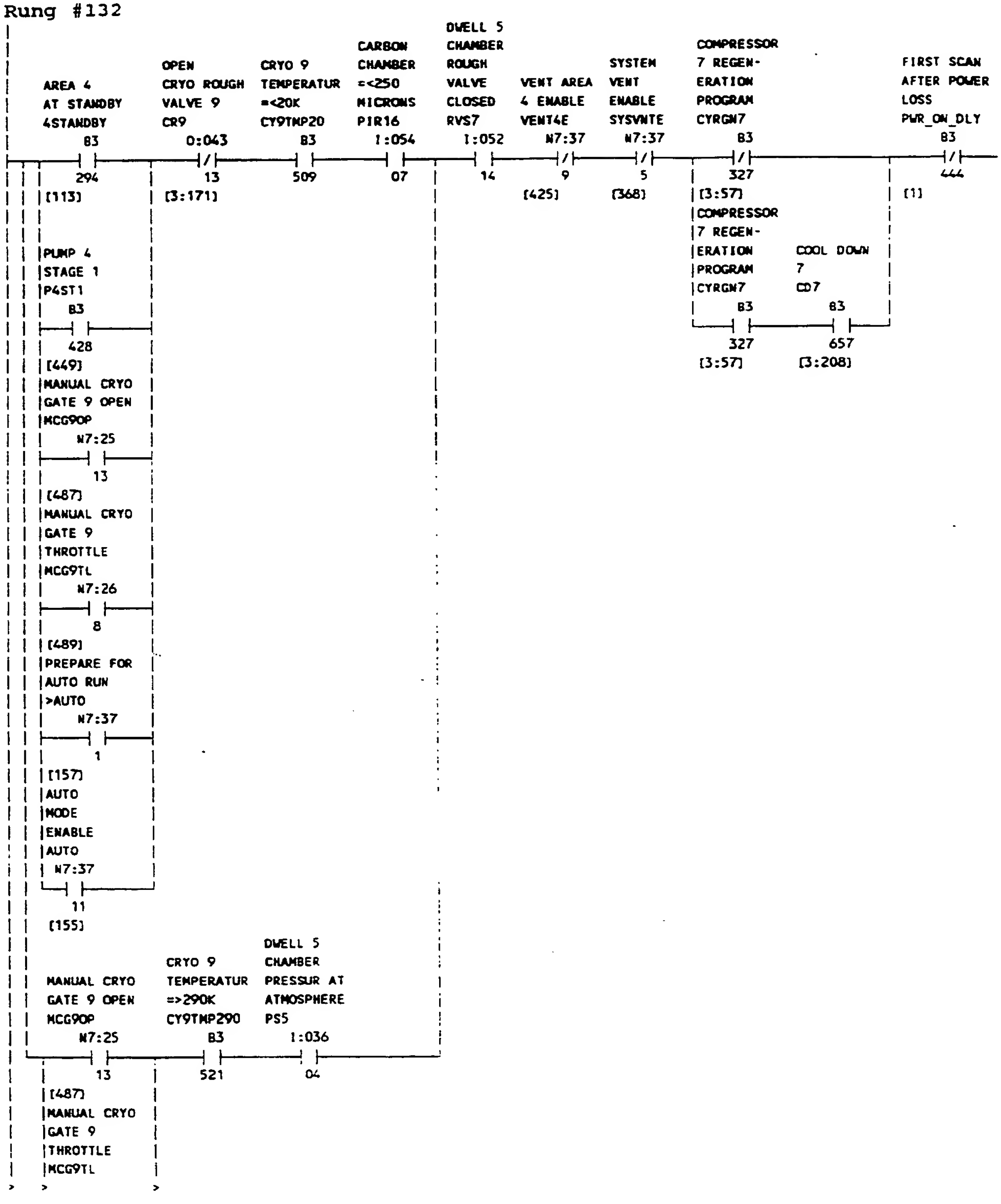
```
|                                               DWELL 5
|                                     CARBON    CHAMBER                         COMPRESSOR
|                OPEN       CRYO 9    CHAMBER   ROUGH                 SYSTEM    7 REGEN-                FIRST SCAN
|    AREA 4      CRYO ROUGH TEMPERATUR =<250    VALVE     VENT AREA   VENT      ERATION                 AFTER POWER
|    AT STANDBY  VALVE 9    =<20K     MICRONS   CLOSED    4 ENABLE    ENABLE    PROGRAM                 LOSS
|    4STANDBY    CR9        CY9TMP20  PIR16     RVS7      VENT4E      SYSVNTE   CYRGN7                  PWR_ON_DLY
|       B3        O:043       B3       I:054     I:052     N7:37       N7:37      B3                       B3
+-+-+---| |---+---|/|------| |------| |---+---| |------|/|---------|/|-----+---|/|--------------+-------|/|---
| | |   294   |    13       509        07 |    14        9           5    |   327              |       444
| | |[113]    |  [3:171]                  |             [425]       [368]  |[3:57]              |  [1]
| | |         |                           |                                |COMPRESSOR          |
| | |         |                           |                                |7 REGEN-            |
| | |PUMP 4   |                           |                                |ERATION    COOL DOWN|
| | |STAGE 1  |                           |                                |PROGRAM    7        |
| | |P4ST1    |                           |                                |CYRGN7     CD7      |
| | |  B3     |                           |                                |   B3       B3     |
| | +--| |----+                           |                                +---| |-------| |----+
| | |  428                                |                                    327       657
| | |[449]                                |                                  [3:57]    [3:208]
| | |MANUAL CRYO                          |
| | |GATE 9 OPEN                          |
| | |MCG9OP                               |
| | |  N7:25                              |
| | +---| |---+                           |
| |      13                               |
| |  [487]                                |
| |                     DWELL 5           |
| |            CRYO 9   CHAMBER           |
| |MANUAL CRYO TEMPERATUR PRESSUR AT      |
| |GATE 9 OPEN =>290K   ATMOSPHERE        |
| |MCG9OP      CY9TMP290 PS5              |
| |  N7:25       B3      I:036            |
| +---| |--------| |-------| |------------+
|      13       521       04
|  [487]
                                                                          CRYO GATE  |
                                                                                     >
```

```
                                                            SOLENOID 1  |
                                                            DWELL 5     |
                                                            CHAMBER     |
                                                            HV9_1       |
                                                               O:045    |
                                                            -----( )----|
                                                                15      |

O:045/15 - -| |- - File #5 FAULTS -  85
                   File #6 TECH_RUNGS -  7
           -|/|- - File #5 FAULTS -  108,133
           -( )- - File #2 MAIN_PRGRM -  131
```

197

Rung #132


AREA 4
AT STANDBY
4STANDBY
B3
294
[113]
OPEN
CRYO ROUGH
VALVE 9
CR9
O:043
13
[3:171]
CRYO 9
TEMPERATUR
=<20K
CY9TMP20
B3
509
CARBON
CHAMBER
=<250
MICRONS
PIR16
I:054
07
DWELL 5
CHAMBER
ROUGH
VALVE
CLOSED
RVS7
I:052
14
VENT AREA
4 ENABLE
VENT4E
N7:37
9
[425]
SYSTEM
VENT
ENABLE
SYSVNTE
N7:37
5
[368]
COMPRESSOR
7 REGEN-
ERATION
PROGRAM
CYRGN7
B3
327
[3:57]
FIRST SCAN
AFTER POWER
LOSS
PWR_ON_DLY
B3
444
[1]
COMPRESSOR
7 REGEN-
ERATION
PROGRAM
CYRGN7
B3
327
[3:57]
COOL DOWN
7
CD7
B3
657
[3:208]
PUMP 4
STAGE 1
P4ST1
B3
428
[449]
MANUAL CRYO
GATE 9 OPEN
MCG9OP
N7:25
13
[487]
MANUAL CRYO
GATE 9
THROTTLE
MCG9TL
N7:26
8
[489]
PREPARE FOR
AUTO RUN
>AUTO
N7:37
1
[157]
AUTO
MODE
ENABLE
AUTO
N7:37
11
[155]
MANUAL CRYO
GATE 9 OPEN
MCG9OP
N7:25
13
[487]
CRYO 9
TEMPERATUR
=>290K
CY9TMP290
B3
521
DWELL 5
CHAMBER
PRESSUR AT
ATMOSPHERE
PS5
I:036
04
MANUAL CRYO
GATE 9
THROTTLE
MCG9TL

```
N7:26
  8
[489]

CRYO GATE
SOLENOID 2
DWELL 5
CHAMBER
HV9_2
0:045
--( )--
16

0:045/16 - -| |- - File #5 FAULTS - 85,108
                   File #6 TECH_RUNGS - 7
           -|/|- - File #5 FAULTS - 133
           -( )- - File #2 MAIN_PRGRM - 132
```

Rung #133

```
AREA 4            OPEN            CRYO 10         CARBON          DWELL 5         VENT AREA     SYSTEM        COMPRESSOR      FIRST SCAN
AT STANDBY        CRYO ROUGH      TEMPERATUR      CHAMBER         CHAMBER         4 ENABLE      VENT          7 REGEN-        AFTER POWER
4STANDBY          VALVE 10        =<20K           =<250           ROUGH           VENT4E        ENABLE        ERATION         LOSS
B3                CR10            CY10TMP20       MICRONS         VALVE           N7:37         SYSVNTE       PROGRAM         PWR_ON_DLY
-| |-             0:057           B3              PIR16           CLOSED          -|/|-         N7:37         CYRGN7          B3
294               -|/|-           -| |-           I:054           RVS7            9             -|/|-         B3              -|/|-
[113]             11              510             -| |-           I:052           [425]         5             -|/|-           444
                  [3:172]                         07              -| |-                         [368]         327             [1]
                                                                  14                                          [3:57]

PUMP 4                                                                                                        COMPRESSOR
STAGE 1                                                                                                       7 REGEN-
P4ST1                                                                                                         ERATION         COOL DOWN
B3                                                                                                            PROGRAM         7
-| |-                                                                                                         CYRGN7          CD7
428                                                                                                           B3              B3
[449]                                                                                                         -| |-           -| |-
                                                                                                              327             657
MANUAL CRYO                                                                                                   [3:57]          [3:208]
GATE 10 OPEN
MCG10OP
N7:25
-| |-
14
[491]

                  CYRO 10         DWELL 5
MANUAL CRYO       TEMPERATUR      CHAMBER
GATE 10 OPEN      =>290K          PRESSUR AT
MCG10OP           CY10TMP290      ATMOSPHERE
N7:25             B3              PS5
-| |-             -| |-           I:036
14                522             -| |-
[491]                             04

CRYO GATE
SOLENOID 1
DWELL 6
CHAMBER
HV10_1
0:061
--( )--
11

0:061/11 - -| |- - File #5 FAULTS - 87,110
```

File #6 TECH_RUNG. 7
-|/|- - File #5 FAULTS - 135
-( )- - File #2 MAIN_PRGRM - 133

Rung #134

AREA 4 AT STANDBY 4STANDBY B3 -| |- 294 [113]
PUMP 4 STAGE 1 P4ST1 B3 -| |- 428 [449]
MANUAL CRYO GATE 10 OPEN MCG10OP N7:25 -| |- 14 [491]
MANUAL CRYO GATE 10 THROTTLE MCG10TL N7:26 -| |- 9 [493]
PREPARE FOR AUTO RUN >AUTO N7:37 -| |- 1 [157]
AUTO MODE ENABLE AUTO N7:37 -| |- 11 [155]

OPEN CRYO ROUGH VALVE 10 CR10 O:057 -|/|- 11 [3:172]
CRYO 10 TEMPERATUR =<20K CY10TMP20 B3 -| |- 510
CARBON CHAMBER =<250 MICRONS PIR16 I:054 -| |- 07

MANUAL CRYO GATE 10 OPEN MCG10OP N7:25 -| |- 14 [491]
CYRO 10 TEMPERATUR =>290K CY10TMP290 B3 -| |- 522
DWELL 5 CHAMBER PRESSUR AT ATMOSPHERE PS5 I:036 -| |- 04

DWELL 5 CHAMBER ROUGH VALVE CLOSED RVS7 I:052 -| |- 14
VENT AREA 4 ENABLE VENT4E N7:37 -|/|- 9 [425]
SYSTEM VENT ENABLE SYSVNTE N7:37 -|/|- 5 [368]

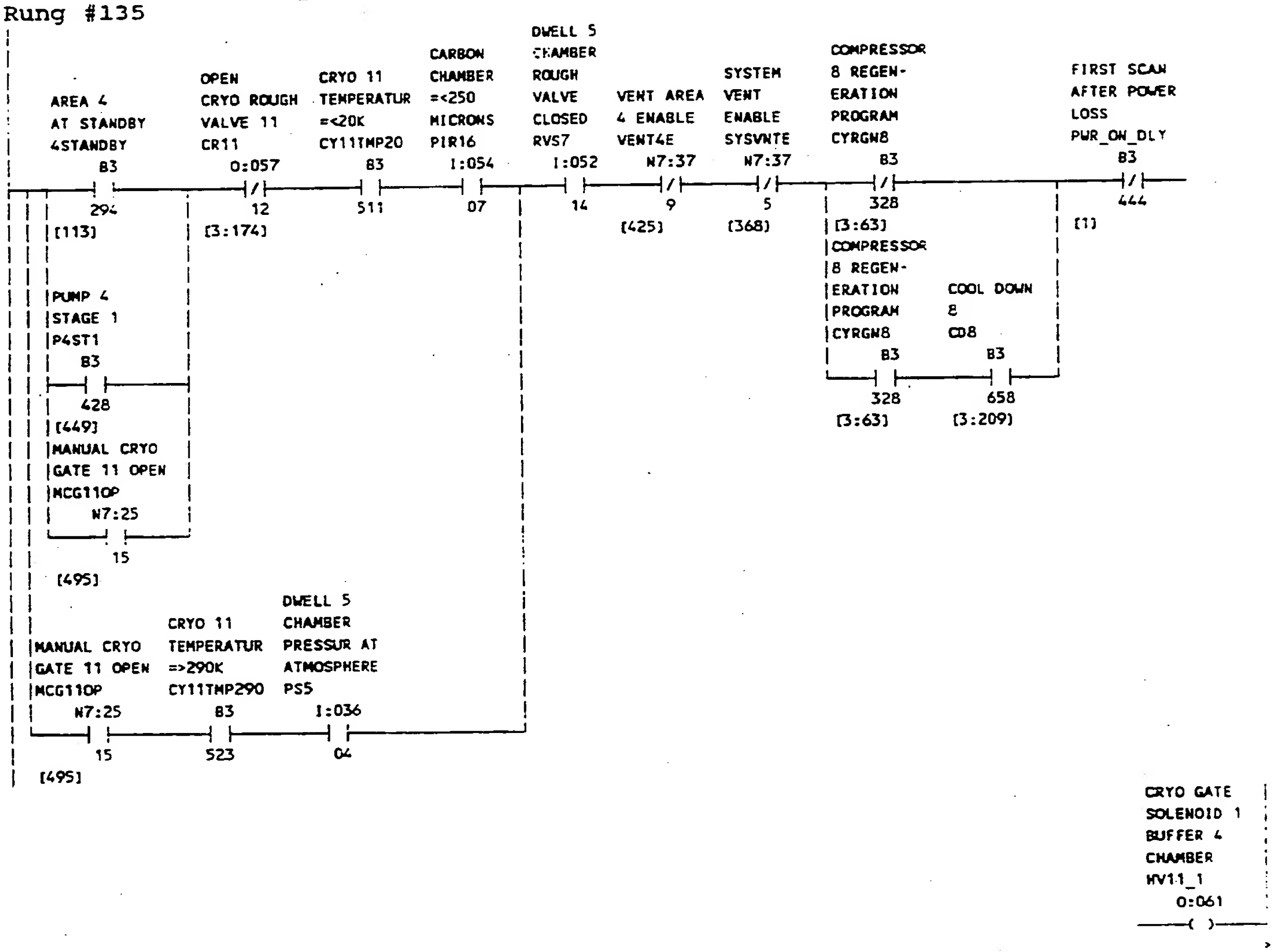
COMPRESSOR 7 REGEN-ERATION PROGRAM CYRGN7 B3 -|/|- 327 [3:57]
COMPRESSOR 7 REGEN-ERATION PROGRAM CYRGN7 B3 -| |- 327 [3:57] COOL DOWN 7 CD7 B3 -| |- 657 [3:208]

FIRST SCAN AFTER POWER LOSS PWR_ON_DLY B3 -|/|- 444 [1]

MANUAL CRYO
> > >

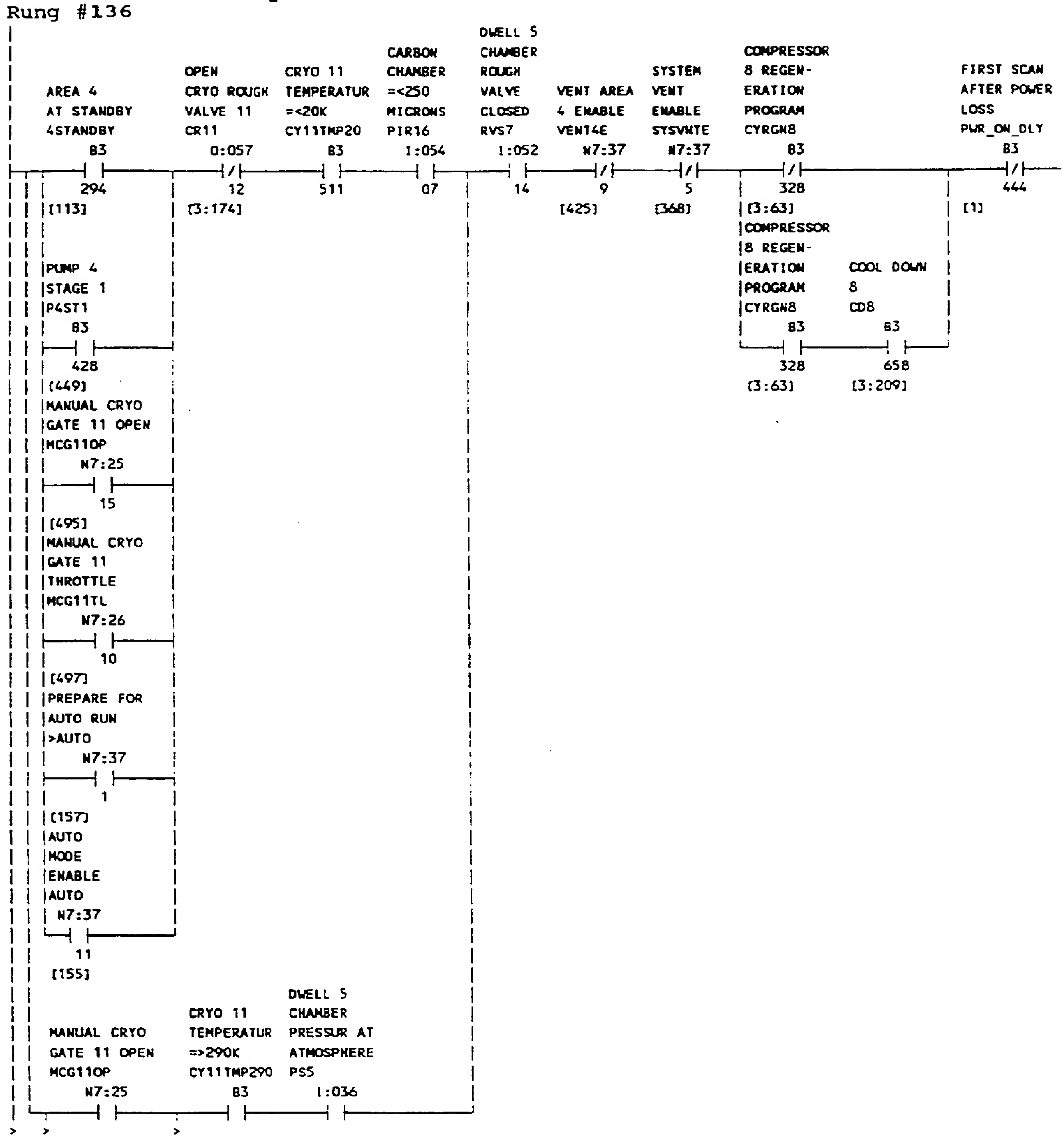
O:061/12 - ‑| |‑ - File #5 FAULTS - 87
File #6 TECH_RUNGS - 7
‑|/|‑ - File #5 FAULTS - 110,135
‑( )‑ - File #2 MAIN_PRGRM - 134

Rung #135



0:061/13 - ┤ ├ - File #5 FAULTS - 89
File #6 TECH_RUNGS - 7
┤/├ - File #5 FAULTS - 112,137
-( )- - File #2 MAIN_PRGRM - 135

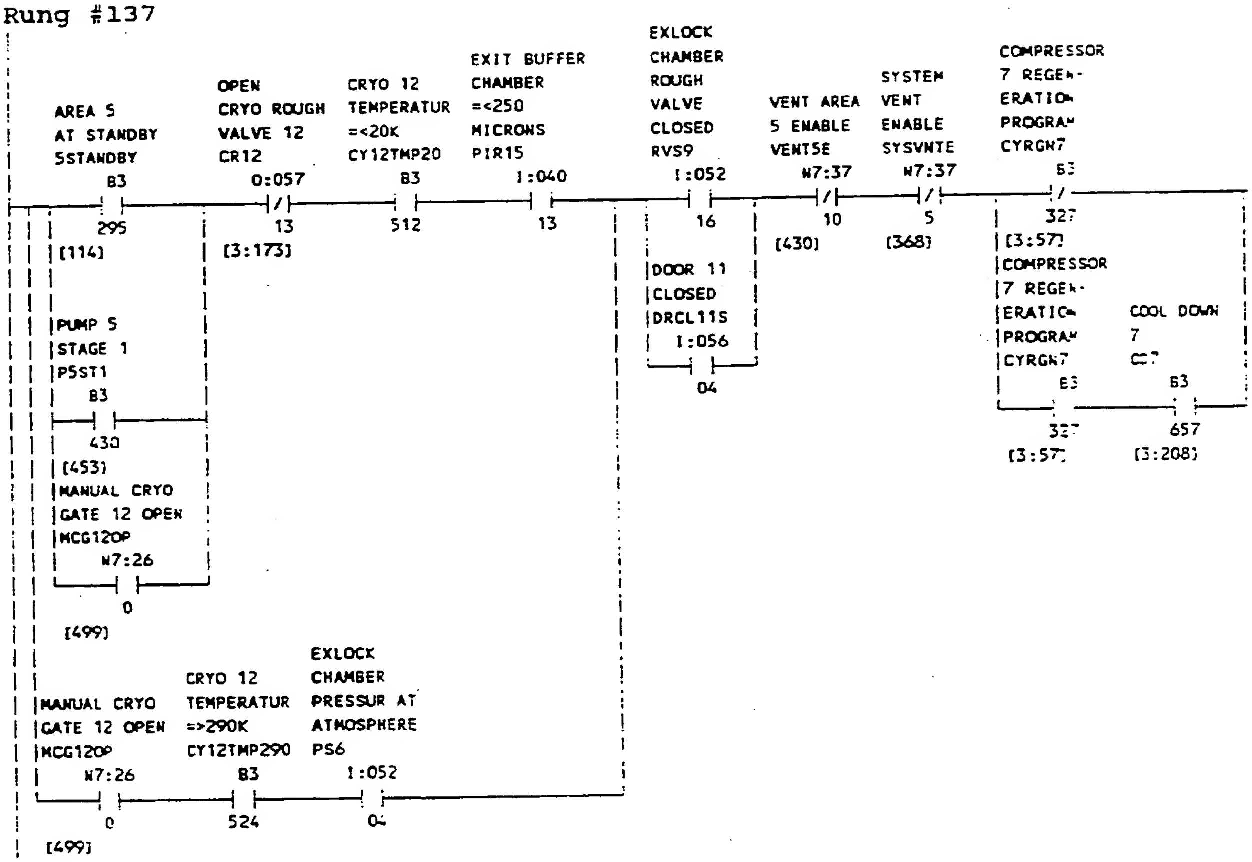
Rung #136



202

O:061/14 - ┤ ├ - File #5 FAULTS - 89,112
File #6 TECH_RUNGS - 7
┤/├ - File #5 FAULTS - 137
-( )- - File #2 MAIN_PRGRM - 136

Rung #137



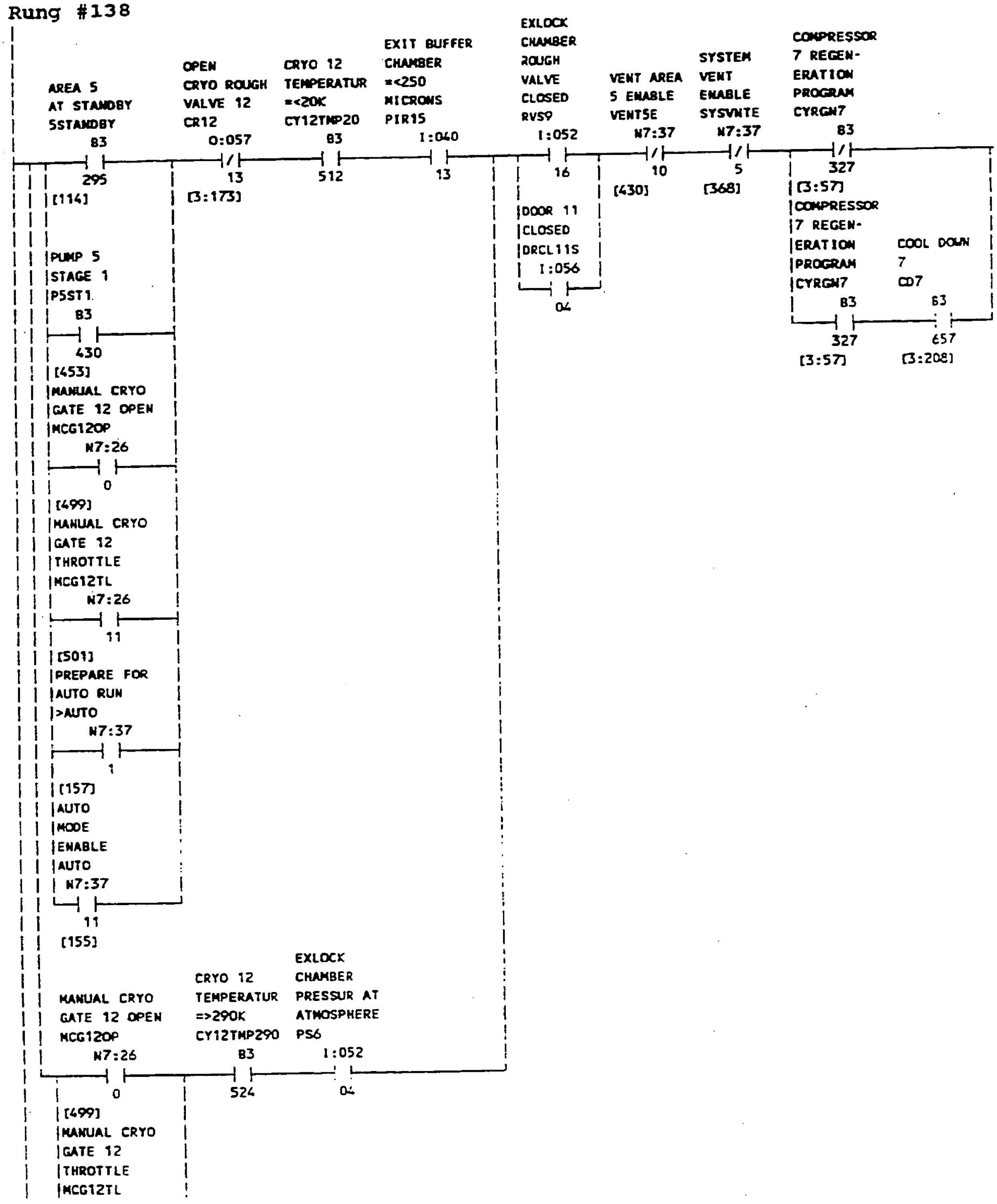
FIRST SCAN
AFTER POWER
LOSS

CRYO GATE
SOLENOID 1
EXBUFFER
CHAMBER

```
PWR_ON_DLY    HV12_1
    B3        O:061
---]/[----------( )---
   444          15
[1]
```

```
O:061/15 - ] [ - - File #5 FAULTS -  91
                   File #6 TECH_RUNGS -  7
          ]/[ - - File #5 FAULTS -  114,139
          -( )- - File #2 MAIN_PRGRM -  137
```

Rung #138


AREA 5
AT STANDBY
5STANDBY
B3
295
[114]
OPEN
CRYO ROUGH
VALVE 12
CR12
O:057
13
[3:173]
CRYO 12
TEMPERATUR
=<20K
CY12TMP20
B3
512
EXIT BUFFER
CHAMBER
=<250
MICRONS
PIR15
I:040
13
EXLOCK
CHAMBER
ROUGH
VALVE
CLOSED
RVS9
I:052
16
DOOR 11
CLOSED
DRCL11S
I:056
04
VENT AREA
5 ENABLE
VENT5E
N7:37
10
[430]
SYSTEM
VENT
ENABLE
SYSVNTE
N7:37
5
[368]
COMPRESSOR
7 REGEN-
ERATION
PROGRAM
CYRGN7
B3
327
[3:57]
COMPRESSOR
7 REGEN-
ERATION
PROGRAM
CYRGN7
B3
327
[3:57]
COOL DOWN
7
CD7
B3
657
[3:208]
PUMP 5
STAGE 1
P5ST1
B3
430
[453]
MANUAL CRYO
GATE 12 OPEN
MCG12OP
N7:26
0
[499]
MANUAL CRYO
GATE 12
THROTTLE
MCG12TL
N7:26
11
[501]
PREPARE FOR
AUTO RUN
>AUTO
N7:37
1
[157]
AUTO
MODE
ENABLE
AUTO
N7:37
11
[155]
MANUAL CRYO
GATE 12 OPEN
MCG12OP
N7:26
0
[499]
MANUAL CRYO
GATE 12
THROTTLE
MCG12TL
CRYO 12
TEMPERATUR
=>290K
CY12TMP290
B3
524
EXLOCK
CHAMBER
PRESSUR AT
ATMOSPHERE
PS6
I:052
04

```
<  <               <
|  |   N7:26       |
|  |-----| |-------|
|          11
|  [501]
                                                      CRYO GATE      |
                                       FIRST SCAN     SOLENOID 2     |
                                       AFTER POWER    EXBUFFER       |
                                       LOSS           CHAMBER        |
                                       PWR_ON_DLY     HV12_2         |
                                           B3           O:061        |
                                      ----|/|------------( )---------|
                                          444             16
                                      [1]
O:061/16 - -| |- - File #5 FAULTS -  91,114
                   File #6 TECH_RUNGS -  7
           -|/|- - File #5 FAULTS -  139
           -( )- - File #2 MAIN_PRGRM -  138
```

Rung #139

```
|                                                         EXITLOCK      |
|DOOR 10                                                  HIVAC BAFFLE  |
|CLOSED                                                   ENABLE        |
|DRCL10S                                                  HV12_3        |
|  I:056                                                    O:061       |
|---| |-----------------------------------------------------(U)---------|
     02                                                       17
O:061/17 - -(L)- - File #2 MAIN_PRGRM -  324
           -(U)- - File #2 MAIN_PRGRM -  139
```

Rung #140

```
|         HEATER 1  CHROME    MAGNETIC  CARBON    EXIT BUFFER
|PUMPDOWN CHAMBER   CHAMBER   CHAMBER   CHAMBER   CHAMBER                 SYSTEM IS
|SYSTEM   =<250     =<250     =<250     =<250     =<250                   PUMPED
|ENABLE   MICRONS   MICRONS   MICRONS   MICRONS   MICRONS                 DOWN
|PDSE     PIR2      PIR6      PIR11     PIR16     PIR15                   SYS_PD
|  B3       I:004     I:024     I:040     I:054     I:040                   B3
|--| |------| |-------| |-------| |-------| |-------| |---------------------( )---|
|  303        10        07        07        07        13                   389
|[23]
B3/389 - -| |- - File #2 MAIN_PRGRM -  22
         -( )- - File #2 MAIN_PRGRM -  140
```

Rung #141

```
|HEATER                                             HEATER SHIELD
|SHIELD H2O                                         FLOW SWITCH
|FLOW                                               1 SENSOR
|SWITCH 1                                           TIMER
|HSFS1                                              HSFS1TMR
|   I:006                                           +--TOF------------+
|----| |--------------------------------------------|TIMER OFF DELAY  |-(EN)-
|      10                                           |TIMER:    T4:191 |
|                                                   |BASE (SEC):  1.0 |-(DN)
| T4:191.DN - -| |- - File #2 MAIN_PRGRM - 147      |PRESET:       20 |
|             -|/|- - File #2 MAIN_PRGRM - 149      |ACCUM:         0 |
|                                                   +-----------------+
```

```
Rung #142
|HEATER                                                                      HEATER SHIELD
|SHIELD H2O                                                                  FLOW SWITCH
|FLOW                                                                        2 SENSOR
|SWITCH 2                                                                    HSFS2TMR
|HSFS2                                                                       +--TOF-----------------+
|   I:006                                                                    |TIMER OFF DELAY       |-(EN)-
|----] [------------------------------------------------------------------- |TIMER:        T4:192  |
|    11                                                                      |BASE (SEC):     1.0   |-(DN)
|                                                                            |PRESET:          20   |
| T4:192.DN - ] [ - File #2 MAIN_PRGRM - 147                                 |ACCUM:            0   |
|             ]/[ - File #2 MAIN_PRGRM - 149                                 +----------------------+

Rung #143
|HEATER                                                                      HEATER SHIELD
|SHIELD H2O                                                                  FLOW SWITCH
|FLOW                                                                        3 TIMER
|SWITCH 3                                                                    HSFS3TMR
|HSFS3                                                                       +--TOF-----------------+
|   I:006                                                                    |TIMER OFF DELAY       |-(EN)-
|----] [------------------------------------------------------------------- |TIMER:        T4:193  |
|    12                                                                      |BASE (SEC):     1.0   |-(DN)
|                                                                            |PRESET:          20   |
| T4:193.DN - ] [ - File #2 MAIN_PRGRM - 148                                 |ACCUM:            0   |
|             ]/[ - File #2 MAIN_PRGRM - 150                                 +----------------------+

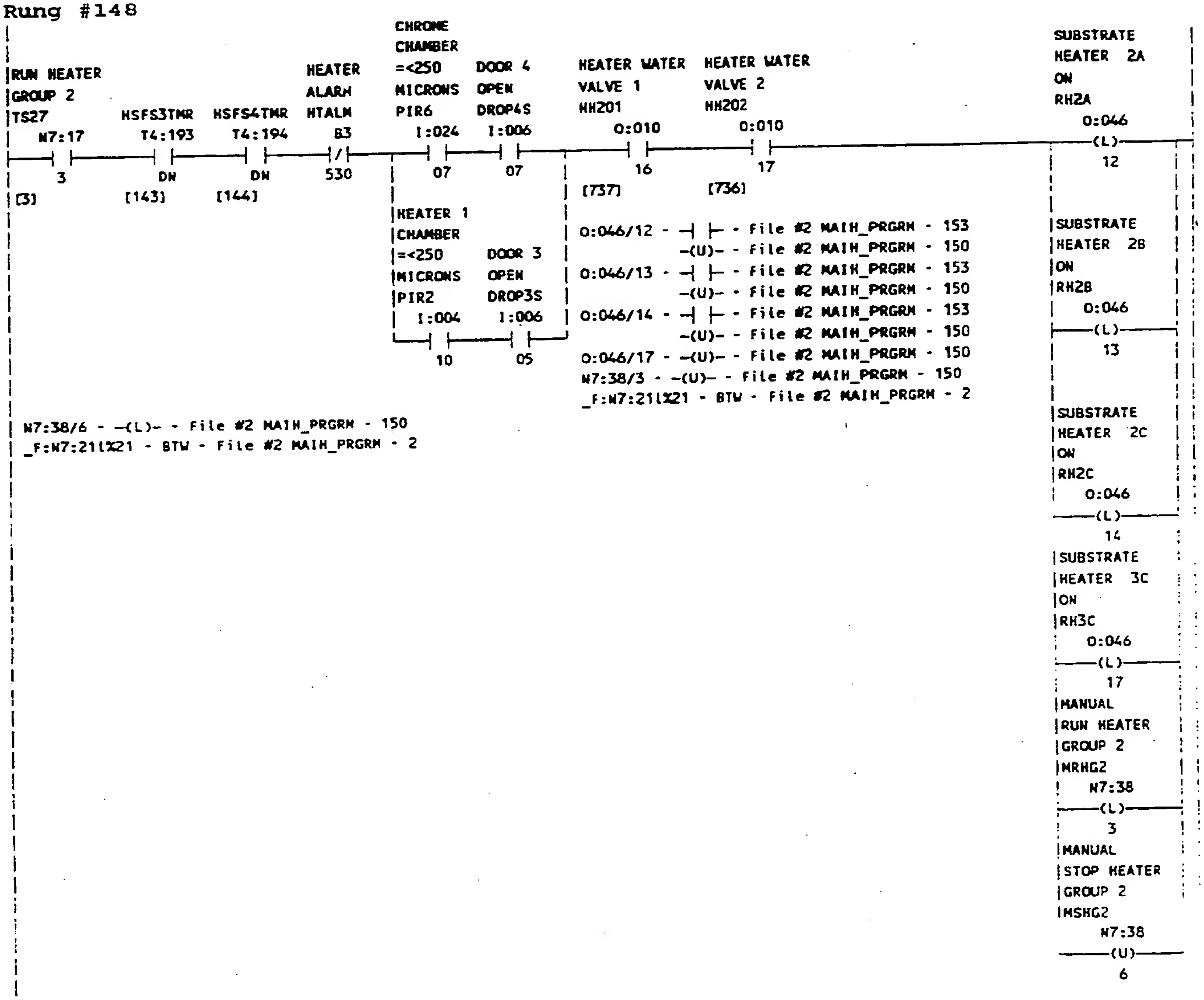
Rung #144
|HEATER                                                                      HEATER SHIELD
|SHIELD H2O                                                                  FLOW SWITCH
|FLOW                                                                        4 TIMER
|SWITCH 4                                                                    HSFS4TMR
|HSFS4                                                                       +--TOF-----------------+
|   I:006                                                                    |TIMER OFF DELAY       |-(EN)-
|----] [------------------------------------------------------------------- |TIMER:        T4:194  |
|    13                                                                      |BASE (SEC):     1.0   |-(DN)
|                                                                            |PRESET:          20   |
| T4:194.DN - ] [ - File #2 MAIN_PRGRM - 148                                 |ACCUM:            0   |
|             ]/[ - File #2 MAIN_PRGRM - 150                                 +----------------------+

Rung #145
|HEATER                                                                      HEATER SHIELD
|SHIELD H2O                                                                  FLOW SWITCH
|FLOW                                                                        5 TIMER
|SWITCH 5                                                                    HSFS5TMR
|HSFS5                                                                       +--TOF-----------------+
|   I:023                                                                    |TIMER OFF DELAY       |-(EN)-
|----] [------------------------------------------------------------------- |TIMER:        T4:195  |
|    16                                                                      |BASE (SEC):     1.0   |-(DN)
|                                                                            |PRESET:          20   |
|                                                                            |ACCUM:           20   |
|                                                                            +----------------------+
```

```
Rung #146
|HEATER
|SHIELD H20                                              HEATER SHIELD
|FLOW                                                    FLOW SWITCH
|SWITCH 6                                                6 TIMER
|HSFS6                                                   HSFS6TMR
|  I:023                                                 +-TOF------------+
|---] [---------------------------------------------------|TIMER OFF DELAY |-(EN)-
|   17                                                   |TIMER:   T4:196 |
|                                                        |BASE (SEC): 1.0|-(DN)
|                                                        |PRESET:      20|
|                                                        |ACCUM:       20|
|                                                        +----------------+

Rung #147
|                                       HEATER 1
|                                       CHAMBER                                   SUBSTRATE
|RUN HEATER                     HEATER  =<250    HEATER WATER HEATER WATER        HEATER 1A
|GROUP 1                        ALARM   MICRONS  VALVE 1      VALVE 2             ON
|TS26     HSFS1TMR  HSFS2TMR    HTALM   PIR2     HH201        HH202               RH1A
|  N7:17    T4:191    T4:192     B3     I:004     O:010        O:010               O:046
|---] [------] [-------] [-------]/[-----] [--------] [----------] [------------+----(L)----
|    2         DN        DN      530      10        16           17            |     10
|[3]        [141]     [142]                       [737]         [736]          |
| O:046/10 - ] [ - - File #2 MAIN_PRGRM - 153                                  |SUBSTRATE
|            -(U)- - File #2 MAIN_PRGRM - 149                                  |HEATER 1B
| O:046/11 - ] [ - - File #2 MAIN_PRGRM - 153                                  |ON
|            -(U)- - File #2 MAIN_PRGRM - 149                                  |RH1B
| O:046/15 - -(U)- - File #2 MAIN_PRGRM - 149                                  |  O:046
| O:046/16 - -(U)- - File #2 MAIN_PRGRM - 149                                  +----(L)----
| N7:38/2 - -(U)- - File #2 MAIN_PRGRM - 149                                   |     11
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                                  |
| N7:38/5 - -(L)- - File #2 MAIN_PRGRM - 149                                   |
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                                  |SUBSTRATE
|                                                                              |HEATER 3A
|                                                                              |ON
|                                                                              |RH3A
|                                                                              |  O:046
|                                                                              +----(L)----
|                                                                              |     15
|                                                                              |SUBSTRATE
|                                                                              |HEATER 3B
|                                                                              |ON
|                                                                              |RH3B
|                                                                              |  O:046
|                                                                              +----(L)----
|                                                                              |     16
|                                                                              |MANUAL
|                                                                              |RUN HEATER
|                                                                              |GROUP 1
|                                                                              |MRHG1
|                                                                              |  N7:38
|                                                                              +----(L)----
|                                                                              |     2
|                                                                              |MANUAL
|                                                                              |STOP HEATER
|                                                                              |GROUP 1
|                                                                              |MSHG1
|                                                                              |  N7:38
|                                                                              +----(U)----
|                                                                                    5
```

Rung #148


RUN HEATER
GROUP 2
TS27
N7:17
3
[3]
HSFS3TMR
T4:193
DN
[143]
HSFS4TMR
T4:194
DN
[144]
HEATER
ALARM
HTALM
B3
530
CHROME
CHAMBER
=<250
MICRONS
PIR6
I:024
07
DOOR 4
OPEN
DROP4S
I:006
07
HEATER 1
CHAMBER
=<250
MICRONS
PIR2
I:004
10
DOOR 3
OPEN
DROP3S
I:006
05
HEATER WATER
VALVE 1
HH201
O:010
16
[737]
HEATER WATER
VALVE 2
HH202
O:010
17
[736]
O:046/12 - -| |- - File #2 MAIN_PRGRM - 153
-(U)- - File #2 MAIN_PRGRM - 150
O:046/13 - -| |- - File #2 MAIN_PRGRM - 153
-(U)- - File #2 MAIN_PRGRM - 150
O:046/14 - -| |- - File #2 MAIN_PRGRM - 153
-(U)- - File #2 MAIN_PRGRM - 150
O:046/17 - -(U)- - File #2 MAIN_PRGRM - 150
N7:38/3 - -(U)- - File #2 MAIN_PRGRM - 150
_F:N7:21(X21 - BTW - File #2 MAIN_PRGRM - 2
N7:38/6 - -(L)- - File #2 MAIN_PRGRM - 150
_F:N7:21(X21 - BTW - File #2 MAIN_PRGRM - 2
SUBSTRATE
HEATER 2A
ON
RH2A
O:046
(L)
12
SUBSTRATE
HEATER 2B
ON
RH2B
O:046
(L)
13
SUBSTRATE
HEATER 2C
ON
RH2C
O:046
(L)
14
SUBSTRATE
HEATER 3C
ON
RH3C
O:046
(L)
17
MANUAL
RUN HEATER
GROUP 2
MRHG2
N7:38
(L)
3
MANUAL
STOP HEATER
GROUP 2
MSHG2
N7:38
(U)
6

Rung #149

```
STOP HEATER                                              SUBSTRATE
GROUP 1                                                  HEATER 1A
TS29                                                     ON
                                                         RH1A
   N7:17                                                   O:046
---| |----+----------------------------------------------+---(U)---
     5    |                                              |    10
[3]       |                                              |
          | O:046/10 - -| |- - File #2 MAIN_PRGRM - 153  | SUBSTRATE
          |          -(L)- - File #2 MAIN_PRGRM - 147    | HEATER 1B
          | O:046/11 - -| |- - File #2 MAIN_PRGRM - 153  | ON
          |          -(L)- - File #2 MAIN_PRGRM - 147    | RH1B
          | O:046/15 - -(L)- - File #2 MAIN_PRGRM - 147  |   O:046
          | O:046/16 - -(L)- - File #2 MAIN_PRGRM - 147  +---(U)---
HSFS1TMR  | N7:38/2 - -(L)- - File #2 MAIN_PRGRM - 147   |    11
 T4:191   | _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2  |
---|/|----+ N7:38/5 - -(U)- - File #2 MAIN_PRGRM - 147   | SUBSTRATE
   DN     | _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2  | HEATER 3A
[141]     |                                              | ON
          |                                              | RH3A
          |                                              |   O:046
          |                                              +---(U)---
HSFS2TMR  |                                              |    15
 T4:192   |                                              |
---|/|----+                                              | SUBSTRATE
   DN     |                                              | HEATER 3B
[142]     |                                              | ON
          |                                              | RH3B
          |                                              |   O:046
          |                                              +---(U)---
HEATER    |                                              |    16
ALARM     |                                              |
HTALM     |                                              | MANUAL
   B3     |                                              | RUN HEATER
---| |----+                                              | GROUP 1
   530    |                                              | MRHG1
          |                                              |   N7:38
          |                                              +---(U)---
HEATER WATER                                             |    2
VALVE 2   |                                              |
HH202     |                                              | MANUAL
   O:010  |                                              | STOP HEATER
---|/|----+                                              | GROUP 1
    17    |                                              | MSHG1
[736]     |                                              |   N7:38
          |                                              +---(L)---
HEATER WATER                                                  5
VALVE 1   |
HH201     |
   O:010  |
---|/|----+
    16    |
[737]     |
AUTO OFF  |
PULSE     |
AUOFPULSE |
>  >      >                                                        >
```

T4:283
TT
[155]

Rung #150

STOP HEATER
GROUP 2
TS30
N7:17
6
[3]

0:046/12 - ┤ ├ - File #2 MAIN_PRGRM - 153
-(L)- - File #2 MAIN_PRGRM - 148
0:046/13 - ┤ ├ - File #2 MAIN_PRGRM - 153
-(L)- - File #2 MAIN_PRGRM - 148
0:046/14 - ┤ ├ - File #2 MAIN_PRGRM - 153
-(L)- - File #2 MAIN_PRGRM - 148
0:046/17 - -(L)- - File #2 MAIN_PRGRM - 148
N7:38/3 - -(L)- - File #2 MAIN_PRGRM - 148
_F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2
N7:38/6 - -(U)- - File #2 MAIN_PRGRM - 148
_F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2

HSFS3TMR
T4:193
DN
[143]

HSFS4TMR
T4:194
DN
[144]

HEATER WATER
VALVE 2
HH202
0:010
17
[736]

HEATER WATER
VALVE 1
HH201
0:010
16
[737]

HEATER
ALARM
HTALM
B3
530
AUTO OFF

SUBSTRATE
HEATER 2A
ON
RH2A
0:046
-(U)-
12

SUBSTRATE
HEATER 2B
ON
RH2B
0:046
-(U)-
13

SUBSTRATE
HEATER 2C
ON
RH2C
0:046
-(U)-
14

SUBSTRATE
HEATER 3C
ON
RH3C
0:046
-(U)-
17

MANUAL
RUN HEATER
GROUP 2
MRHG2
N7:38
-(U)-
3

MANUAL
STOP HEATER
GROUP 2
MSHG2
N7:38
-(L)-
6

```
< <                  <
| |PULSE             |
| |AUOFPULSE         |
| | T4:283           |
| L---] [------------
|      TT
| [155]
Rung #151
|HEATER
|ALARM                                                        HEATER ALARM
|HTALM                                                        HTRALM
|  B3                                                             B3
|--] [-----------------------------------------------------------(L)----
|  530                                                            290
B3/290 - ] [ - File #2 MAIN_PRGRM - 628
         -(L)- - File #2 MAIN_PRGRM - 151
         -(U)- - File #2 MAIN_PRGRM - 152
Rung #152
|PAUSE
|DISABLE                                                      HEATER ALARM
|TS12                                                         HTRALM
| N7:16                                                           B3
|--] [-----------------------------------------------------------(U)----
|   4                                                             290
|[3]
B3/290 - ] [ - File #2 MAIN_PRGRM - 628
         -(L)- - File #2 MAIN_PRGRM - 151
         -(U)- - File #2 MAIN_PRGRM - 152
Rung #153
|SUBSTRATE SUBSTRATE SUBSTRATE SUBSTRATE SUBSTRATE SUBSTRATE SUBSTRATE SUBSTRATE SUBSTRATE  SUBSTRATE  SUBSTRATE
|HEATER    HEATER    HEATER    HEATER    HEATER    HEATER    HEATER    HEATER    HEATER 1A  HEATER 1B  HEATER 2A
|SET HIGH  SET HIGH  SET HIGH  SET HIGH  SET HIGH  SET HIGH  SET HIGH  SET HIGH  ON         ON         ON
|HH1A      HH1B      HH2A      HH2B      HH2C      HH3A      HH3B      HH3C      RH1A       RH1B       RH2A
| 0:046    0:046     0:046     0:046     0:046     0:046     0:046     0:046     0:046      0:046      0:046
|--]/[-----]/[-------]/[-------]/[-------]/[-------]/[-------]/[-------]/[-------] [--------] [--------] [---
|   00       01        02        03        04        05        06        07       10         11         12
|[213]     [213]     [227]     [227]     [227]     [213]     [213]     [227]     [149]      [149]      [150]
                                                                                                ALL
                                                                  SUBSTRATE  SUBSTRATE  SUBSTRATE
                                                                  HEATER 2B  HEATER 2C  HEATERS
                                                                  ON         ON         SET LOW
                                                                  RH2B       RH2C       ASHSL
                                                                   0:046      0:046       B3
                                                                  ---] [--------] [-------( )---
                                                                     13         14        398
                                                                  [150]      [150]
B3/398 - ] [ - File #2 MAIN_PRGRM - 158
         -( )- - File #2 MAIN_PRGRM - 153
Rung #154
|                                                                                  DOORS 1,2,3,9,
|DOOR 1  DOOR 2  DOOR 3  DOOR 9  DOOR 11  DOOR 12  DOOR 4  DOOR 5  DOOR 6  DOOR 7  DOOR 8  DOOR 10   11,12 CLOSED:
|CLOSED  CLOSED  CLOSED  OPEN    CLOSED   CLOSED   OPEN    OPEN    OPEN    OPEN    OPEN    CLOSED    4,5,6,7,8 OPEN
|DRCL1S  DRCL2S  DRCL3S  DROP9S  DRCL11S  DRCL12S  DROP4S  DROP5S  DROP6S  DROP7S  DROP8S  DRCL10S   DRS_OK
| I:006  I:006   I:006   I:056   I:056    I:056    I:006   I:026   I:026   I:042   I:042   I:056        B3
|--] [----] [----] [----] [-----] [------] [------] [-----] [-----] [-----] [-----] [-----] [----------( )---
|  00      02      04      01      04       06       07      01      03      01      03      02          396
B3/396 - ] [ - File #2 MAIN_PRGRM - 158
         -( )- - File #2 MAIN_PRGRM - 154
```

212

Rung #155

```
|                  POWER SUPPLIES    POWER SUPPLIES                                                  AUTO
| AUTO MODE        CHROME,MAG-A      MAGB,CARBON                                                     MODE
| DISABLE          ON                ON                                                              ENABLE
| TS10             PS_CH_MA_ON       PS_HB_CR_ON                                                     AUTO
|    N7:16             B3                B3                                                          N7:37
|-+---] [------------]/[---------------]/[---+----------------------------------------------------+--(U)--+-
| |    2              527               543  |                                                    |   11  |
| |[3]                                       |                                                    |       |
| |                                          |                                                    |AUTO OFF
| |FIRST SCAN                                |                                                    |PULSE
| |AFTER POWER                               |                                                    |AUOFPULSE
| |LOSS                                      |                                                    | +-TON--------------+
| |PWR_ON_DLY                                |                                                    +-|TIMER ON DELAY    |-(EN)-
| |     B3                                   |                                                      |TIMER:     T4:283 |
| +----] [-----------------------------------+                                                      |BASE (SEC):   1.0 |-(DN)
|      444                                                                                          |PRESET:         5 |
|  [1]                                                                                              |ACCUM:          0 |
|                                                                                                   +------------------+
```

N7:37/11 -] [- File #2 MAIN_PRGRM - 15, 115, 118, 120, 122, 124, 126, 128, 130, 132, 134, 136, 138, 159, 160, 162, 163, 165, 168, 173, 174, 180, 181, 185, 187, 190, 195, 197, 199, 200, 202, 204, 205, 206, 207, 208, 209, 211, 214, 218, 222, 226, 229, 231, 233, 235, 237, 238, 243, 249, 253, 255, 258, 263, 265, 267, 269, 270, 275, 281, 285, 287, 290, 295, 297, 299, 300, 306, 310, 312, 315, 320, 324, 327, 331, 335, 337, 338, 341, 346, 347, 351, 355, 614, 616, 624, 625, 630, 631, 633

File #5 FAULTS - 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14

]/[- File #2 MAIN_PRGRM - 84, 98, 104, 116, 187, 200, 212, 327, 369, 405, 411, 418, 425, 430, 674, 676, 684, 688, 690, 698

-(L)- - File #2 MAIN_PRGRM - 158

_F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2

T4:283.DN -] [- File #2 MAIN_PRGRM - 711

T4:283.TT -] [- File #2 MAIN_PRGRM - 38, 39, 40, 41, 42, 44, 45, 84, 98, 105, 106, 107, 108, 109, 149, 150, 223, 237, 240, 243, 269, 272, 275

Rung #156

```
|OPEN                                                                  GAS FLOW
|GAS FLOW    GAS FLOW    GAS FLOW                                      VALVES
|ISOLATION   ISOLATION   ISOLATION                                     3,5,7
|VALVE 3     VALVE 5     VALVE 7                                       ARE OPEN
|GF3         GF5         GF7                                           MAST-VAL
|  O:030       O:044       O:060                                          B3
|----] [--------] [---------] [-------------------------------------------( )--
|     07          07          07                                          148
|[40]        [42]        [44]
```

B3/148 -] [- File #2 MAIN_PRGRM - 158

-( )- - File #2 MAIN_PRGRM - 156

Rung #157

```
|PREPARE                                                               PREPARE FOR
|FOR AUTO RUN                                                          AUTO RUN
|ENABLE                                                                >AUTO
|TS09                                                                    N7:37
|    N7:16
|----] [------------------------------------------------------------------(L)--
|      1                                                                  1
|[3]
```

N7:37/1 -] [- File #2 MAIN_PRGRM - 17,22,46,47,48,49,68,78,110,111,112,113,114,115,118,120,122,124,126,128,130,132,134,136,138 158,183,202,229,325,335,337,353,368,381,383,385,386,410,415,417,424,429,433,437,441,446,450,454,458,460,462,464,466 468,470,472,474,476,478,480,482,484,486,488,490,492,494,496,498,500,502,508,509,510,511,512,551,552,553,554,555,556 557,558,559,560,561,562,563,564,565,566,567,568,569,589,590,591,592,593,594,595,596,597,598,599,600,601,602,603,604 605,606,607,625

File #3 CRYO_REGEN - 25,238,239,240,241,242,243,244

-(L)- - File #2 MAIN_PRGRM - 157

-(U)- - File #2 MAIN_PRGRM - 162

_F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2

Rung #158

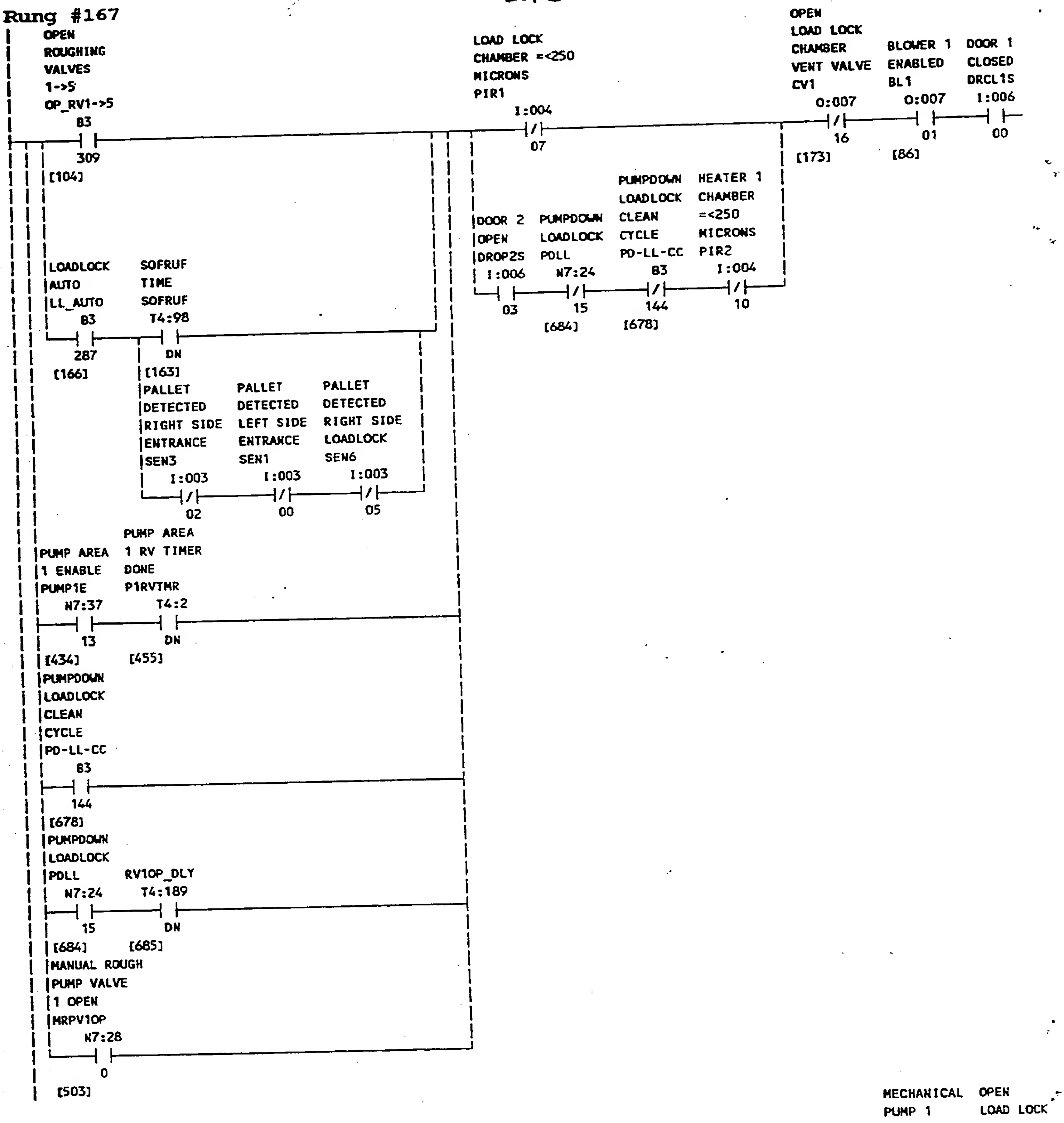
```
|                GAS FLOW                                                                     COMPUTER   ALL
|                VALVES               MECHANICAL              MECHANICAL              SIGNAL FOR SUBSTRATE  DOORS 1,2,3,9,
|PREPARE FOR     3,5,7               PUMP 1       BLOWER 1   PUMP 3       BLOWER 3   AUTO MODE  HEATERS    11,12 CLOSED:
|AUTO RUN        ARE OPEN  DOOR FAULT ENABLED     ENABLED    ENABLED      ENABLED    OK         SET LOW    4,5,6,7,8 OPEN
|>AUTO           MAST-VAL  DRFLT      MP1         BL1        MP3          BL3        COMPAUTO   ASHSL      DRS_OK
|   N7:37         B3        B3        0:007       0:007      0:057        0:057      N7:16      B3         B3
|----] [---------] [-------]/[-------] [---------] [--------] [----------] [--------] [--------] [---------] [----
|    1           148       215        00          01         00           01         11         398        396
|[157]          [156]     [5:67]     [89]        [86]       [103]        [100]      [3]        [153]      [154]
| N7:37/11 - ] [ - File #2 MAIN_PRGRM - 15, 115, 118, 120, 122, 124, 126, 128, 130, 132, 134, 136, 138,
|                  159, 160, 162, 163, 165, 168, 173, 174, 180, 181, 185, 187, 190, 195, 197, 199,
|                  200, 202, 204, 205, 206, 207, 208, 209, 211, 214, 218, 222, 226, 229, 231, 233,
|                  235, 237, 238, 243, 249, 253, 255, 258, 263, 265, 267, 269, 270, 275, 281, 285,
|                  287, 290, 295, 297, 299, 300, 306, 310, 312, 315, 320, 324, 327, 331, 335, 337,
|                  338, 341, 346, 347, 351, 355, 614, 616, 624, 625, 630, 631, 633
|                  File #5 FAULTS - 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14
|          ]/[ - File #2 MAIN_PRGRM - 84, 98, 104, 116, 187, 200, 212, 327, 369, 405, 411, 418, 425,
|                  430, 674, 676, 684, 688, 690, 698
|          -(U)- - File #2 MAIN_PRGRM - 155
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2
  T4:282.TT - ] [ - File #2 MAIN_PRGRM - 165, 338, 711
                                                                                        AUTO
                                                                                        MODE
                                                                                        ENABLE
                                                                                        AUTO
                                                                                         N7:37
                                                                                     ----(L)----------
                                                                                     |   11          |
                                                                                     |AUTO ON        |
                                                                                     |PULSE          |
                                                                                     |AUTOPULSE      |
                                                                                     | +-TON-----------+
                                                                                     +-|TIMER ON DELAY |-(EN)-
                                                                                       |TIMER:   T4:282|
                                                                                       |BASE (SEC): 1.0|-(DN)
                                                                                       |PRESET:       5|
                                                                                       |ACCUM:        0|
                                                                                       +---------------+
```

Rung #159

```
| AUTO
| MODE
| ENABLE                                                                              RETURN CONVEYOR
| AUTO                                                                                ON
|  N7:37                                                                              RTNCVYR
|                                                                                          0:060
|---] [----------------------------------------------------------------------------------(L)------
| |  11              |                                                                       01
| |[158]             |
| |                  | 0:060/01 - -(U)- - File #2 MAIN_PRGRM - 161
| |MANUAL CONTROL    |
| |RETURN CONVEYOR   |
| |RTNCNVYR          |
| |      I:055       |
| +-------] [--------+
|         03
```

```
Rung #160
| AUTO                                                              RETURN CONVEYOR
| MODE                                                              OFF DELAY
| ENABLE                                                            RC_OFF
| AUTO                                                              --TOF-----------
|  N7:37                                                            |TIMER OFF DELAY |-(EN)-
|---] [------------------------------------------------------------|TIMER:    T4:332|
|  |  11        :                                                   |BASE (SEC):  1.0|-(DN)
|  |[158]       :                                                   |PRESET:    1800|
|  |            : T4:332.DN - -|/|- - File #2 MAIN_PRGRM - 161      |ACCUM:        0|
|  |                                                                ----------------
|  |MANUAL CONTROL :
|  |RETURN CONVEYOR :
|  |RTNCNVYR       :
|  |      I:055    :
|  |-------] [------
|           03
Rung #161
|                                                                   RETURN CONVEYOR
|                                                                   ON
|RC_OFF                                                             RTNCVYR
| T4:332                                                                 O:060
|---]/[---------------------------------------------------------------(U)-----
|   DN                                                                   01
|[160]
O:060/01 - -(L)- - File #2 MAIN_PRGRM - 159
           -(U)- - File #2 MAIN_PRGRM - 161
Rung #162
| AUTO MODE                                                         PREPARE FOR
| DISABLE                                                           AUTO RUN
| TS10                                                              >AUTO
|     N7:16                                                               N7:37
|--------] [----------------------------------------------------------(U)------
|  |       2      :
|  |[3]           :
|  |              : N7:37/1 - -] [- - File #2 MAIN_PRGRM - 17, 22, 46, 47, 48, 49, 68, 78, 110, 111, 112, 113, 114, 115,
|  |              :                   118, 120, 122, 124, 126, 128, 130, 132, 134, 136, 138, 158, 183, 202, 229, 325,
|  |              :                   335, 337, 353, 368, 381, 383, 385, 386, 410, 415, 417, 424, 429, 433, 437, 441,
|  |AUTO          :                   446, 450, 454, 458, 460, 462, 464, 466, 468, 470, 472, 474, 476, 478, 480, 482,
|  |MODE          :                   484, 486, 488, 490, 492, 494, 496, 498, 500, 502, 508, 509, 510, 511, 512, 551,
|  |ENABLE                            552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567,
|  |AUTO                              568, 569, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602,
|  | N7:37                            603, 604, 605, 606, 607, 625
|  |---] [-------                     File #3 CRYO_REGEN - 25, 238, 239, 240, 241, 242, 243, 244
|      11                   -(L)- - File #2 MAIN_PRGRM - 157
|  [158]        _F:N7:21(%21 - BTW - File #2 MAIN_PRGRM - 3
Rung #163
|                           PALLET
|AUTO                       DETECTED                                SOFT
|MODE    DOOR 1   DOOR 2    RIGHT SIDE                              ROUGHING
|ENABLE  CLOSED   CLOSED    LOADLOCK                                TIMER
|AUTO    DRCL1S   DRCL2S    SEN6                                    SOFRUF
| N7:37   I:006    I:006      I:003                                 --TON-----------
|---] [----] [-----] [--------] [----------------------------------|TIMER ON DELAY  -(EN)-
|   11      00       02         05                                  |TIMER:     T4:98|
|[158]                                                              |BASE (SEC):  1.0|-(DN)
|                                                                   |PRESET:        0
|                                                                   |ACCUM:         0
|                                                                   ----------------
T4:98.DN - -] [- - File #2 MAIN_PRGRM - 167
T4:98.TT - -] [- - File #2 MAIN_PRGRM - 164
```

```
Rung #164
|                                                                  MECH PUMP |
|                                                                  SOFT ROUGH|
|                                                                  VALVE     |
|SOFRUF                                                            SOFRUFVLV |
| T4:98                                                             O:030    |
|-| |--------------------------------------------------------------( )------|
|  TT                                                                00      |
|[163]                                                                       |
Rung #165
|                                                                  LOADLOCK  |
|                                                                  AUTO      |
| AUTOPULSE                                                        LL_AUTO   |
|   T4:282                                                            B3     |
|-+----| |-----+---------------------------------------------------(L)------|
| |      TT    |                                                     287     |
| |[158]       |                                                             |
| |            | B3/287 - -| |- - File #2 MAIN_PRGRM - 167, 183              |
| |            |         -(U)- - File #2 MAIN_PRGRM - 166                    |
| |       COMPUTER                                                           |
| |AUTO   SIGNAL FOR                                                         |
| |MODE   AUTO MODE                                                          |
| |ENABLE OK                                                                 |
| |AUTO   COMPAUTO                                                           |
| | N7:37    N7:16                                                           |
| +--| |------| |--+                                                          |
|    11        11                                                            |
|  [158]     [3]                                                             |
Rung #166
| VENT                                                             LOADLOCK  |
| LOAD LOCK                                                        AUTO      |
| VNT_LL                                                           LL_AUTO   |
|   N7:24                                                             B3     |
|-+----| |----+----------------------------------------------------(U)------|
| |      13   |                                                      287     |
| |[674]      |                                                              |
| |           | B3/287 - -| |- - File #2 MAIN_PRGRM - 167, 183               |
| |           |         -(L)- - File #2 MAIN_PRGRM - 165                     |
| |PUMP-VENT  |                                                              |
| |CYCLE LOAD |                                                              |
| |LOCK       |                                                              |
| |PD-VNT-LL  |                                                              |
| |   N7:24   |                                                              |
| +----| |----+                                                              |
| |     14    |                                                              |
| |[676]      |                                                              |
| |AUTO MODE  |                                                              |
| |DISABLE    |                                                              |
| |TS10       |                                                              |
| |   N7:16   |                                                              |
| +----| |----+                                                              |
|       2                                                                    |
|  [3]                                                                       |
```

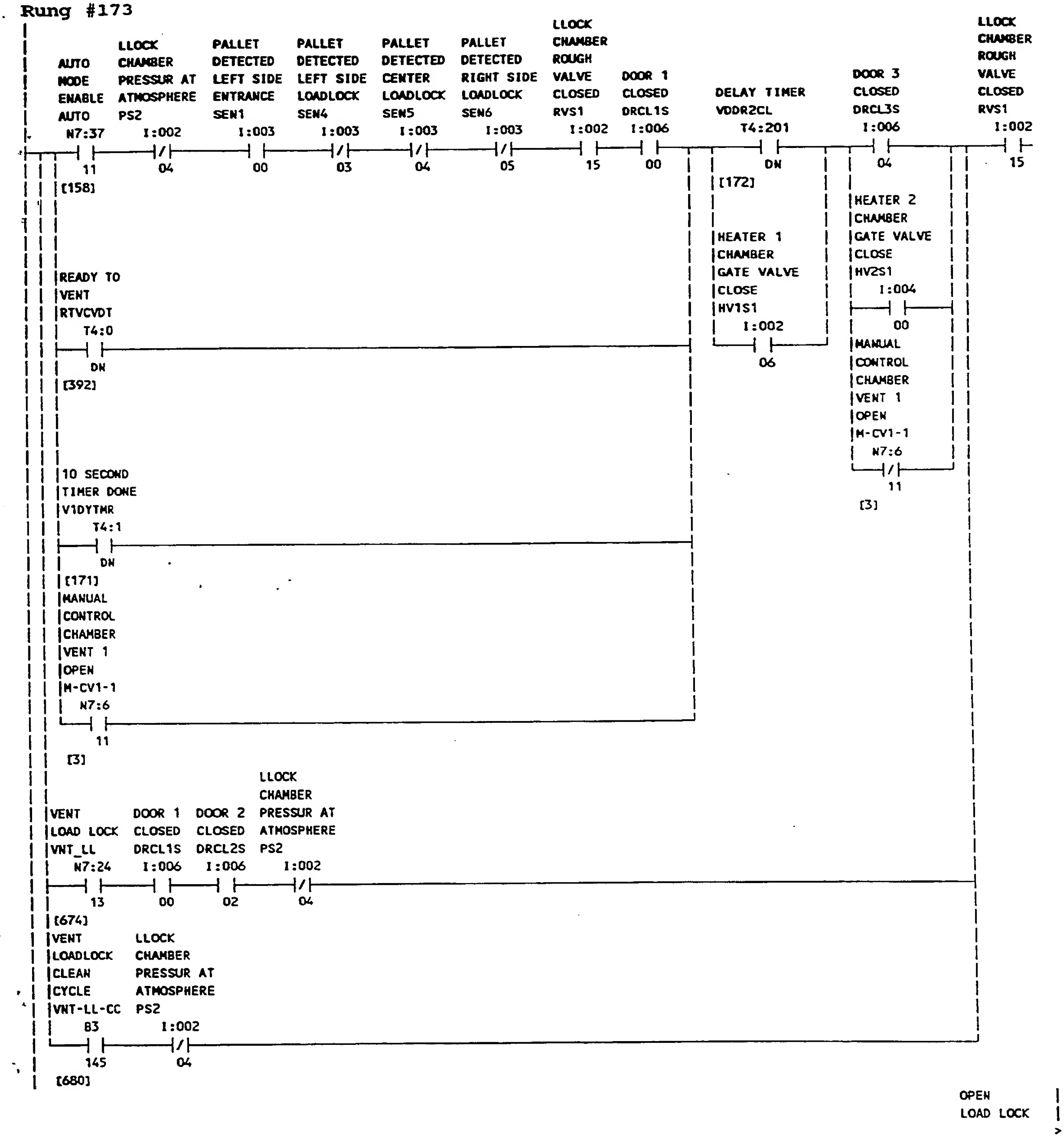

Rung #167
OPEN ROUGHING VALVES 1->5 OP_RV1->5
B3
309
[104]
LOAD LOCK CHAMBER =<250 MICRONS PIR1
I:004
07
OPEN LOAD LOCK CHAMBER VENT VALVE CV1
O:007
16
[173]
BLOWER 1 ENABLED BL1
O:007
01
[86]
DOOR 1 CLOSED DRCL1S
I:006
00
DOOR 2 OPEN DROP2S
I:006
03
PUMPDOWN LOADLOCK POLL
N7:24
15
[684]
PUMPDOWN LOADLOCK CLEAN CYCLE PD-LL-CC
B3
144
[678]
HEATER 1 CHAMBER =<250 MICRONS PIR2
I:004
10
LOADLOCK AUTO LL_AUTO
B3
287
[166]
SOFRUF TIME SOFRUF
T4:98
DN
[163]
PALLET DETECTED RIGHT SIDE ENTRANCE SEN3
I:003
02
PALLET DETECTED LEFT SIDE ENTRANCE SEN1
I:003
00
PALLET DETECTED RIGHT SIDE LOADLOCK SEN6
I:003
05
PUMP AREA 1 ENABLE PUMP1E
N7:37
13
[434]
PUMP AREA 1 RV TIMER DONE P1RVTMR
T4:2
DN
[455]
PUMPDOWN LOADLOCK CLEAN CYCLE PD-LL-CC
B3
144
[678]
PUMPDOWN LOADLOCK POLL
N7:24
15
[684]
RV1OP_DLY
T4:189
DN
[685]
MANUAL ROUGH PUMP VALVE 1 OPEN MRPV1OP
N7:28
0
[503]
MECHANICAL PUMP 1
OPEN LOAD LOCK

```
                                                              ISOLATION   ROUGH      |
                                                              VALVE OPEN  VALVE      |
                                                              MP1IVOP     RV1        |
                                                               I:005       O:010     |
                                                              ---] [---------( )-----|
                                                                 13          11      |

O:010/11 - -] [- - File #2 MAIN_PRGRM -  168
                   File #5 FAULTS -  159
                   File #6 TECH_RUNGS -  0
           -]/[- - File #5 FAULTS -  161
           -( )- - File #2 MAIN_PRGRM -  167
Rung #168
|        OPEN                                                                          |
|AUTO    LOAD LOCK                                                                     |
|MODE    ROUGH                                                  LOAD LOCK              |
|ENABLE  VALVE                                                  ROUGH TIMER            |
|AUTO    RV1                                                    LLRUFFTMR              |
| N7:37    O:010                                                +-TON-----------+      |
|--] [------] [-------------------------------------------------+TIMER ON DELAY +-(EN)-|
|   11       11                                                 |TIMER:   T4:113|      |
|[158]    [167]                                                 |BASE (SEC):  1.0+-(DN)|
|                                                               |PRESET:      60|      |
|                                                               |ACCUM:        0|      |
|                                                               +---------------+      |
T4:113.DN - -] [- - File #2 MAIN_PRGRM -  169
Rung #169
|                                                                        LOAD LOCK     |
|                                                                        ROUGHING      |
|                                                                        >60 SECONDS   |
|LLRUFFTMR                                                               LLRUF>60      |
| T4:113                                                                    B3         |
|----] [------------------------------------------------------------------(L)---------|
|     DN                                                                    816        |
|[168]                                                                                 |
B3/816 - -] [- - File #2 MAIN_PRGRM -  626
         -(L)- - File #2 MAIN_PRGRM -  169
         -(U)- - File #2 MAIN_PRGRM -  170
Rung #170
|                                                                        LOAD LOCK     |
|PAUSE                                                                   ROUGHING      |
|DISABLE                                                                 >60 SECONDS   |
|TS12                                                                    LLRUF>60      |
| N7:16                                                                     B3         |
|----] [------------------------------------------------------------------(U)---------|
|     4                                                                      816        |
|[3]                                                                                   |
B3/816 - -] [- - File #2 MAIN_PRGRM -  626
         -(L)- - File #2 MAIN_PRGRM -  169
         -(U)- - File #2 MAIN_PRGRM -  170
```

```
Rung #171
|         HEATER 1
|         CHAMBER                                                    VENT 1 STAGE1
|VENT 1   GATE VALVE                                                 DELAY TIMER
|STAGE 1  CLOSE                                                      V1DYTMR
|V1ST1    HV1S1                                                      +-TON----------------+
|  B3       I:002                                                    |TIMER ON DELAY      |-(EN)-
|--] [------] [------------------------------------------------------|TIMER:         T4:1 |
   412       06   |                                                  |BASE (SEC):     1.0 |-(DN)
|[409]            |                                                  |PRESET:         5   |
|                 | T4:1.DN - - - - File #2 MAIN_PRGRM - 173           |ACCUM:          0   |
|                 |                                                  +--------------------+
|       |DOOR 1   |
|       |CLOSED   |
|       |DRCL1S   |
|       | I:006   |
|       |--] [----+
|          00
Rung #172
|                                                                    VENT DELAY
|DOOR 2                                                              ON DOOR 2
|CLOSED                                                              CLOSE.
|DRCL2S                                                              VDDR2CL
| I:006                                                              +-TON----------------+
|--] [---------------------------------------------------------------|TIMER ON DELAY      |-(EN)-
   02                                                                |TIMER:       T4:201 |
                                                                     |BASE (SEC):     1.0 |-(DN)
 T4:201.DN - - - - File #2 MAIN_PRGRM - 173                          |PRESET:         2   |
                                                                     |ACCUM:          0   |
                                                                     +--------------------+
```

Rung #173


AUTO MODE ENABLE AUTO
N7:37
11
[158]
LLOCK CHAMBER PRESSUR AT ATMOSPHERE PS2
I:002
04
PALLET DETECTED LEFT SIDE ENTRANCE SEN1
I:003
00
PALLET DETECTED LEFT SIDE LOADLOCK SEN4
I:003
03
PALLET DETECTED CENTER LOADLOCK SEN5
I:003
04
PALLET DETECTED RIGHT SIDE LOADLOCK SEN6
I:003
05
LLOCK CHAMBER ROUGH VALVE CLOSED RVS1
I:002
15
DOOR 1 CLOSED DRCL1S
I:006
00
DELAY TIMER VDDR2CL
T4:201
DN
[172]
HEATER 1 CHAMBER GATE VALVE CLOSE HV1S1
I:002
06
DOOR 3 CLOSED DRCL3S
I:006
04
HEATER 2 CHAMBER GATE VALVE CLOSE HV2S1
I:004
00
MANUAL CONTROL CHAMBER VENT 1 OPEN M-CV1-1
N7:6
11
[3]
LLOCK CHAMBER ROUGH VALVE CLOSED RVS1
I:002
15
READY TO VENT RTVCVDT
T4:0
DN
[392]
10 SECOND TIMER DONE V1DYTMR
T4:1
DN
[171]
MANUAL CONTROL CHAMBER VENT 1 OPEN M-CV1-1
N7:6
11
[3]
VENT LOAD LOCK VNT_LL
N7:24
13
[674]
DOOR 1 CLOSED DRCL1S
I:006
00
DOOR 2 CLOSED DRCL2S
I:006
02
LLOCK CHAMBER PRESSUR AT ATMOSPHERE PS2
I:002
04
VENT LOADLOCK CLEAN CYCLE VNT-LL-CC
B3
145
[680]
LLOCK CHAMBER PRESSUR AT ATMOSPHERE PS2
I:002
04
OPEN LOAD LOCK

```
                                                              CHAMBER
                                                              VENT VALVE
                                                              CV1
                                                                 O:007
                                                          -------(L)-----
                                                                  16

O:007/16 - -| |- - File #2 MAIN_PRGRM -  174
                   File #6 TECH_RUNGS -  0
           -|/|- - File #2 MAIN_PRGRM -  67,167,181,181,368,436,675,681
           -(L)- - File #2 MAIN_PRGRM -  173
           -(U)- - File #2 MAIN_PRGRM -  177
```

Rung #174

```
|        OPEN                                             ENTRANCE
|AUTO    LOAD LOCK                                        LOCK VENT
|MODE    CHAMBER                                          TIMER
|ENABLE  VENT VALVE                                       LDVNTTIMER
|AUTO    CV1                                             +-TON-------------+
| N7:37      O:007                                       |                 |
|--| |--------| |----------------------------------------+TIMER ON DELAY   +-(EN)-
|   11        16                                         |TIMER:    T4:143 |
|[158]     [173]                                         |BASE (SEC):  1.0 +-(DN)
|                                                        |PRESET:      100 |
|                                                        |ACCUM:         0 |
|                                                        +-----------------+

T4:143.DN - -| |- - File #2 MAIN_PRGRM -  175
```

Rung #175

```
|                                                          LOAD LOCK
|                                                          VENT >30 SECS
|LDVNTTIMER                                                LLVNT>30SECS
|  T4:143                                                     B3
|----| |----------------------------------------------------(L)-----
|     DN                                                      814
|[174]
B3/814 - -| |- - File #2 MAIN_PRGRM -  626
         -(L)- - File #2 MAIN_PRGRM -  175
         -(U)- - File #2 MAIN_PRGRM -  176
```

Rung #176

```
|PAUSE                                                     LOAD LOCK
|DISABLE                                                   VENT >30 SECS
|TS12                                                      LLVNT>30SECS
| N7:16                                                       B3
|---| |-----------------------------------------------------(U)-----
|    4                                                        814
|[3]
B3/814 - -| |- - File #2 MAIN_PRGRM -  626
         -(L)- - File #2 MAIN_PRGRM -  175
         -(U)- - File #2 MAIN_PRGRM -  176
```

Rung #177

OPEN
LOAD LOCK
CHAMBER
VENT VALVE
CV1
0:007
(U)
16

CV1_DLY
T4:317
DN
[178]

MANUAL
CONTROL
CHAMBER
VENT 1
CLOSE
M-CV1-0
N7:4
0
[3]

HEATER 1
CHAMBER
GATE VALVE DOOR 2
CLOSE CLOSED
HV1S1 DRCL2S
I:002 I:006
06 02

ABORT SYSTEM
VENT
BORT_SYS_VNT
N7:17
10
[3]

O:007/16 - ┤ ├ - File #2 MAIN_PRGRM - 174
File #6 TECH_RUNGS - 0
┤/├ - File #2 MAIN_PRGRM - 67, 167, 181, 368, 436, 675, 681
-(L)- - File #2 MAIN_PRGRM - 173

Rung #178

LLOCK
CHAMBER
PRESSUR AT
ATMOSPHERE
PS2
I:002
04

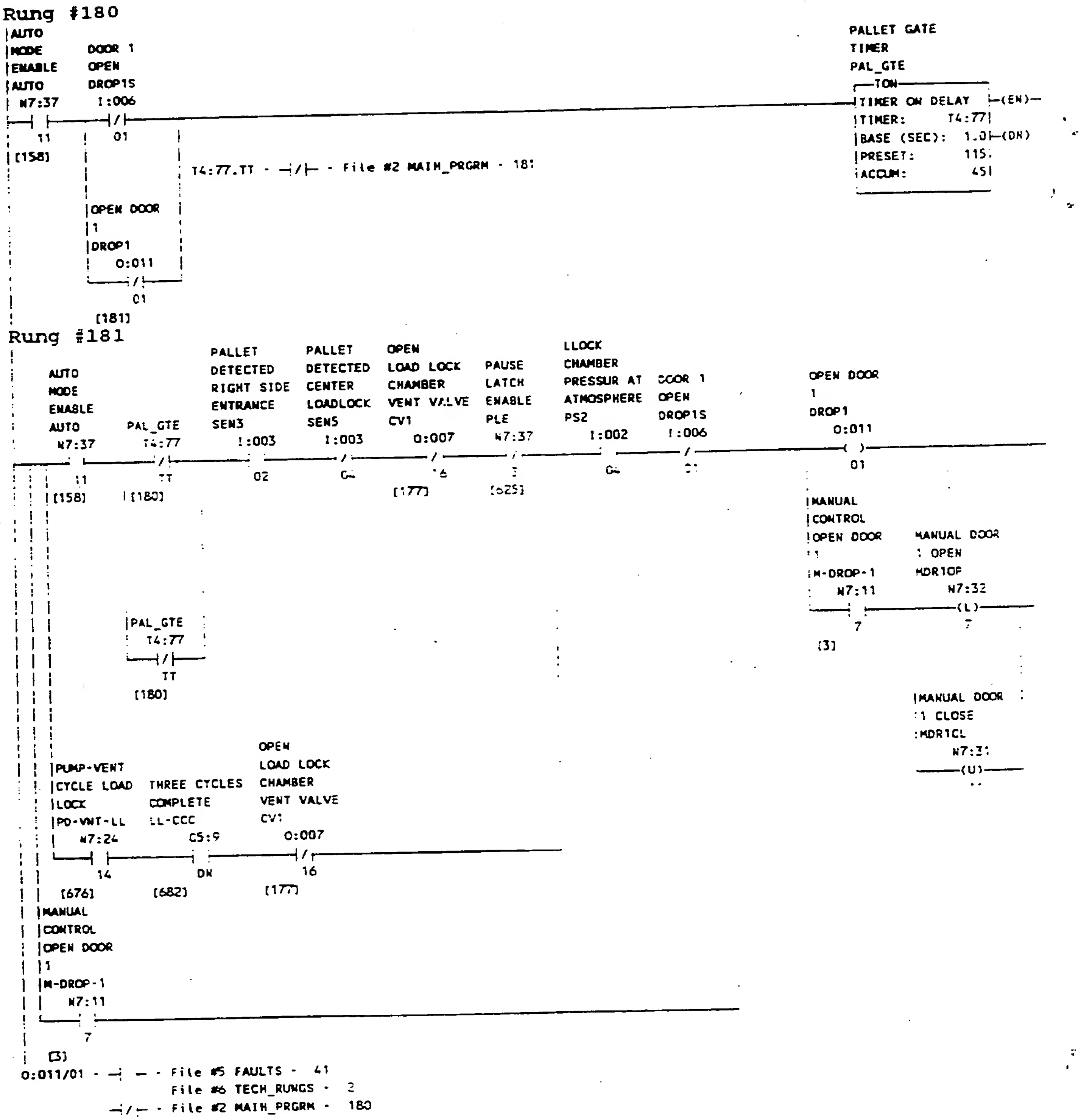
CHAMBER VENT 1
CLOSE DELAY
CV1_DLY
TON
TIMER ON DELAY (EN)
TIMER: T4:317
BASE (SEC): 1.0 (DN)
PRESET: 1
ACCUM: 0

T4:317.DN - ┤ ├ - File #2 MAIN_PRGRM - 177

Rung #179

DOOR 1
OPEN
DROP1S
I:006
01

LOAD LOCK
AIR SWEEP
SOLENOID
LLSWEEP
O:011
( )
10

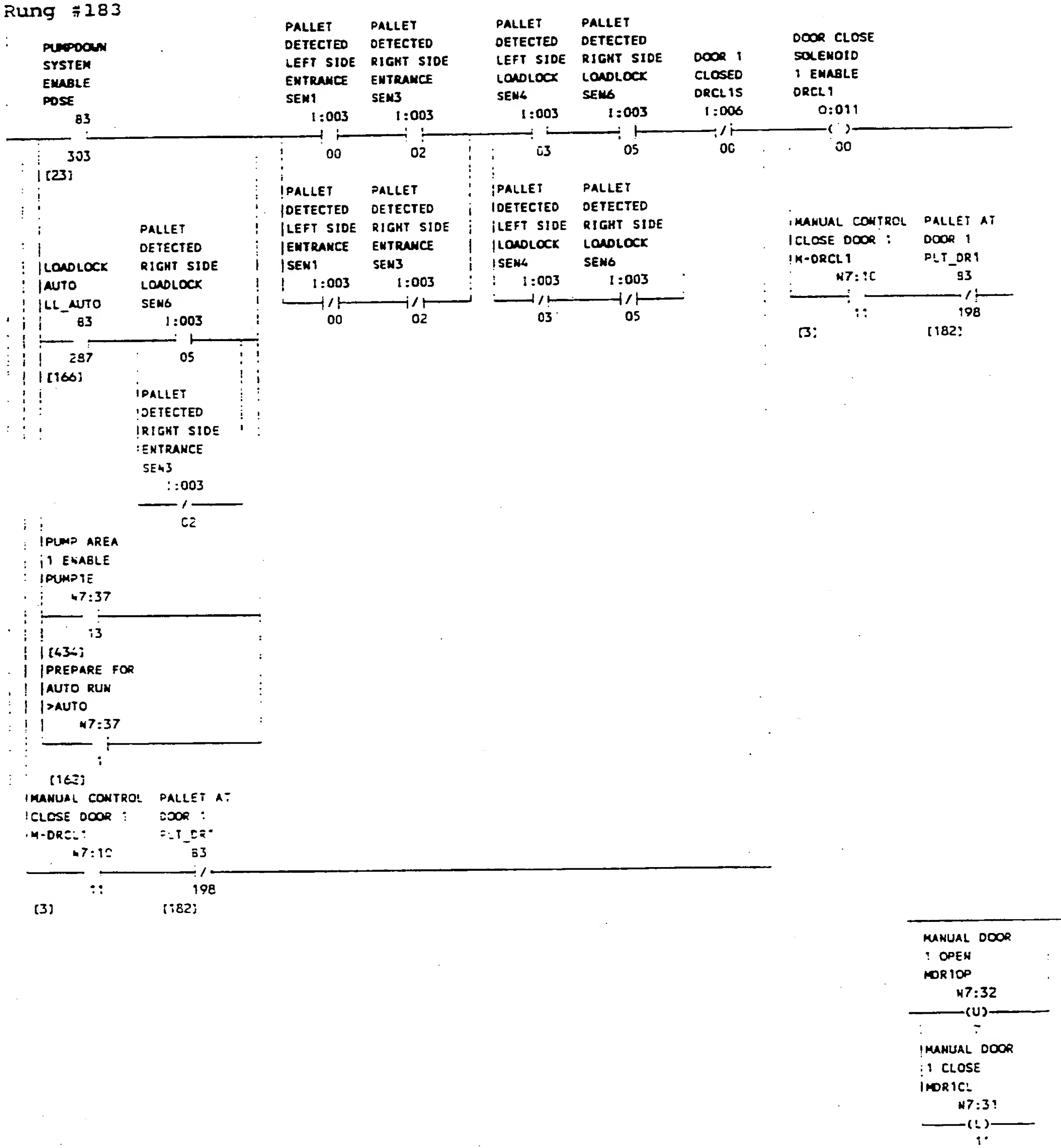

Rung #180
AUTO MODE ENABLE AUTO N7:37 11 [158]
DOOR 1 OPEN DROP1S I:006 01
T4:77.TT - -|/|- - File #2 MAIN_PRGRM - 181
OPEN DOOR 1 DROP1 O:011 01 [181]
PALLET GATE TIMER PAL_GTE
TON
TIMER ON DELAY (EN)
TIMER: T4:77
BASE (SEC): 1.0 (DN)
PRESET: 115
ACCUM: 45
Rung #181
AUTO MODE ENABLE AUTO N7:37 11 [158]
PAL_GTE T4:77 TT [180]
PALLET DETECTED RIGHT SIDE ENTRANCE SEN3 I:003 02
PALLET DETECTED CENTER LOADLOCK SEN5 I:003 04
OPEN LOAD LOCK CHAMBER VENT VALVE CV1 O:007 16 [177]
PAUSE LATCH ENABLE PLE N7:37 [625]
LLOCK CHAMBER PRESSUR AT ATMOSPHERE PS2 I:002 04
DOOR 1 OPEN DROP1S I:006 01
OPEN DOOR 1 DROP1 O:011 01
MANUAL CONTROL OPEN DOOR 1 M-DROP-1 N7:11 7 [3]
MANUAL DOOR 1 OPEN MDR1OP N7:32 (L) 7
MANUAL DOOR 1 CLOSE MDR1CL N7:31 (U)
PAL_GTE T4:77 TT [180]
PUMP-VENT CYCLE LOAD LOCK PD-VNT-LL N7:24 14 [676]
THREE CYCLES COMPLETE LL-CCC C5:9 DN [682]
OPEN LOAD LOCK CHAMBER VENT VALVE CV1 O:007 16 [177]
MANUAL CONTROL OPEN DOOR 1 M-DROP-1 N7:11 7 [3]
O:011/01 - -| |- - File #5 FAULTS - 41
File #6 TECH_RUNGS - 2
-|/|- - File #2 MAIN_PRGRM - 180

```
         -( )- - File #2 MAIN_PRGRM    181
N7:32/7 - -(L)- - File #2 MAIN_PRGRM -  181
         -(U)- - File #2 MAIN_PRGRM -  183
_F:N7:21lX21 - BTW - File #2 MAIN_PRGRM -  2
N7:31/11 - -(L)- - File #2 MAIN_PRGRM -  183
         -(U)- - File #2 MAIN_PRGRM -  181
_F:N7:21lX21 - BTW - File #2 MAIN_PRGRM -  2
```

Rung #182

```
  PALLET    PALLET     PALLET                                                        PALLET AT
  DETECTED  DETECTED   DETECTED                                                      DOOR 1
  CENTER    RIGHT SIDE LEFT SIDE                                                     FLT_DR1
  ENTRANCE  ENTRANCE   LOADLOCK                                                        B3
  SEN2      SEN3       SEN4
   I:003     I:003      I:003
 ----] [-------] [--------] [------------------------------------------------------( )---
     01         02         03                                                         198
 | |PALLET    | B3/198 - -|/|- - File #2 MAIN_PRGRM - 183
 | |DETECTED  |
 | |CENTER    |
 | |LOADLOCK  |
 | |SEN5      |
     I:003
  ----] [----
      04
```

Rung #183


PUMPDOWN SYSTEM ENABLE PDSE B3 303 [23]
PALLET DETECTED LEFT SIDE ENTRANCE SEN1 I:003 00
PALLET DETECTED RIGHT SIDE ENTRANCE SEN3 I:003 02
PALLET DETECTED LEFT SIDE LOADLOCK SEN4 I:003 03
PALLET DETECTED RIGHT SIDE LOADLOCK SEN6 I:003 05
DOOR 1 CLOSED DRCL1S I:006 00
DOOR CLOSE SOLENOID 1 ENABLE DRCL1 O:011 00
LOADLOCK AUTO LL_AUTO B3 287 [166]
PALLET DETECTED RIGHT SIDE LOADLOCK SEN6 I:003 05
PALLET DETECTED RIGHT SIDE ENTRANCE SEN3 I:003 02
PALLET DETECTED LEFT SIDE ENTRANCE SEN1 I:003 00
PALLET DETECTED RIGHT SIDE ENTRANCE SEN3 I:003 02
PALLET DETECTED LEFT SIDE LOADLOCK SEN4 I:003 03
PALLET DETECTED RIGHT SIDE LOADLOCK SEN6 I:003 05
MANUAL CONTROL CLOSE DOOR 1 M-DRCL1 N7:10 11 [3]
PALLET AT DOOR 1 PLT_DR1 B3 198 [182]
PUMP AREA 1 ENABLE PUMP1E N7:37 13 [434]
PREPARE FOR AUTO RUN >AUTO N7:37 1 [162]
MANUAL CONTROL CLOSE DOOR 1 M-DRCL1 N7:10 11 [3]
PALLET AT DOOR 1 PLT_DR1 B3 198 [182]
MANUAL DOOR 1 OPEN MDR1OP N7:32 (U) 1
MANUAL DOOR 1 CLOSE MDR1CL N7:31 (L) 1

225

```
O:011/00 - -] [- - File #5 FAULTS -
                   File #6 TECH_RUNGS -  2
          -( )- - File #2 MAIN_PRGRM -  183
N7:32/7 - -(L)- - File #2 MAIN_PRGRM -  181
          -(U)- - File #2 MAIN_PRGRM -  183
_F:N7:21[X21 - BTW - File #2 MAIN_PRGRM -  2
N7:31/11 - -(L)- - File #2 MAIN_PRGRM -  183
          -(U)- - File #2 MAIN_PRGRM -  181
_F:N7:21[X21 - BTW - File #2 MAIN_PRGRM -  2
Rung #184
| MOTOR 3        MOTOR START                                MOTOR 3    |
| FAST PULSE     PULSE                                      INTERRUPT  |
| M3FP           MOPTB                                      M3I        |
|   T4:203         T4:299                                     O:012    |
|-+---] [---+------] [--------------------------------------( )-------|
| |   TT    |      DN                                         02       |
| | [185]   |  [12]                                                    |
| |MOTOR 3  |                                                          |
| |FAST STOP|                                                          |
| |PULSE    |                                                          |
| |M3FSP    |                                                          |
| |  T4:223 |                                                          |
| +---] [---+                                                          |
| |   TT    |                                                          |
| [186]                                                                |
| |MOTOR 3                                                             |
| |SLOW PULSE                                                          |
| |M3SP                                                                |
| |  T4:243                                                            |
| +---] [---+                                                          |
| |   TT    |                                                          |
| |[187]    |                                                          |
| |MOTOR 3  |                                                          |
| |SLOW STOP|                                                          |
| |PULSE    |                                                          |
| |M3SSP    |                                                          |
| |  T4:263 |                                                          |
| +---] [---+                                                          |
|     TT                                                               |
|  [188]                                                               |
```

Rung #185

AUTO MODE ENABLE AUTO N7:37 11 [158]
PALLET DETECTED RIGHT SIDE ENTRANCE SEN3 I:003 02
DOOR 2 CLOSED DRCL2S I:006 02
PALLET DETECTED RIGHT SIDE LOADLOCK SEN6 I:003 05
DOOR 1 OPEN DROP1S I:006 01
PAUSE PALLET IN ENTRANCE MOTOR 3 M3PLL B3 473 [628]
MOTOR 3 REVERSE M3R B3 103 [570]
MOTOR 3 FAST M3F O:012 12

PALLET DETECTED LEFT SIDE LOADLOCK SEN4 I:003 03

MOTOR 3 FAST PULSE M3FP
TON
TIMER ON DELAY (EN)
TIMER: T4:203
BASE (SEC): 0.01 (DN)
PRESET: 100
ACCUM: 0

AUTO MODE ENABLE AUTO N7:37 11 [158]
PALLET DETECTED LEFT SIDE ENTRANCE SEN1 I:003 00
PALLET DETECTED RIGHT SIDE ENTRANCE SEN3 I:003 02

MANUAL MOTOR 3 ON MM3ON N7:23 1 [513]
DOOR 1 OPEN DROP1S I:006 01

PALLET DETECTED RIGHT SIDE ENTRANCE SEN3 I:003 02

O:012/12 - -] [- - File #5 FAULTS - 0
-]/[- - File #2 MAIN_PRGRM - 186
-( )- - File #2 MAIN_PRGRM - 185
T4:203.TT - -] [- - File #2 MAIN_PRGRM - 184

Rung #186

MOTOR 3 FAST M3F O:012 12 [185]

MOTOR 3 FAST STOP PULSE M3FSP
TON
TIMER ON DELAY (EN)
TIMER: T4:223
BASE (SEC): 0.01 (DN)
PRESET: 100
ACCUM: 102

T4:223.TT - -] [- - File #2 MAIN_PRGRM - 184

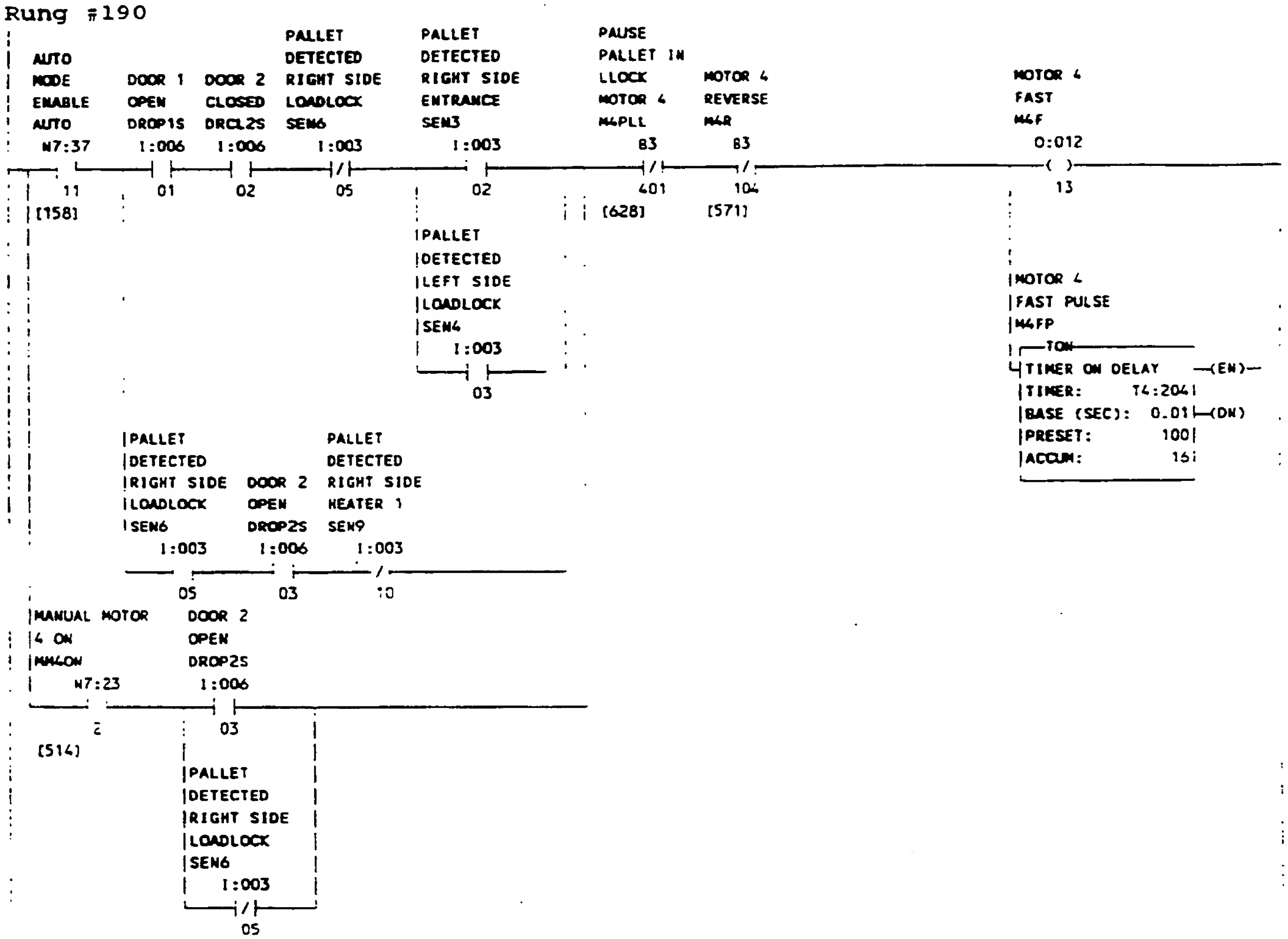
```
Rung #187
                      AUTO                            PAUSE PALLET
 MANUAL MOTOR         MODE       DOOR 1               IN ENTRANCE                                    MOTOR 3
 3 ON                 ENABLE     OPEN                 MOTOR 3                                        SLOW
 MM3ON                AUTO       DROP1S               M3PLL                                          M3S
    N7:23             N7:37       I:006                  B3                                          O:013
 ---] [---------------]/[---------] [-------------------]/[------------------------------------------( )---
                       11          01                    473                                          02
 [513]                [158]     |                   [628]
                                |PALLET
                                |DETECTED           O:013/02 - — ] [ - File #2 MAIN_PRGRM - 15, 187
                                |RIGHT SIDE                  —]/[ - File #2 MAIN_PRGRM - 188         MOTOR 3
                                |ENTRANCE           T4:243.TT - — — - File #2 MAIN_PRGRM - 184       SLOW PULSE
                                |SEN3                                                                M3SP
                                |   I:003                                                            +--TON--------------+
                                +----]/[----+                                                       -|TIMER ON DELAY    |-(EN)-
                                      02                                                             |TIMER:      T4:243|
                                                                                                     |BASE (SEC):   0.01|-(DN)
             PALLET       PALLET                                                                     |PRESET:        100|
 |AUTO       DETECTED     DETECTED                                                                   |ACCUM:           0|
 |MODE       LEFT SIDE    RIGHT SIDE                                                                 +-------------------+
 |ENABLE     ENTRANCE     ENTRANCE
 |AUTO       SEN1         SEN3
 | N7:37       I:003        I:003
 +---] [-------] [----------]/[------
      11         00          02
 [158]
                         PALLET
 |AUTO                   DETECTED
 |MODE       MOTOR 3     RIGHT SIDE
 |ENABLE     SLOW        ENTRANCE
 |AUTO       M3S         SEN3
 | N7:37      O:013        I:003
 +---] [-------] [----------]/[------
      11         02          02
 [158]      [187]
              PALLET
              DETECTED     AUTO
 |MOTOR 3     LEFT SIDE    MODE
 |REVERSE     ENTRANCE     ENABLE
 |M3R         SEN1         AUTO
 |  B3          I:003      N7:37
 +---] [---------]/[---------]/[------
     103          00         11
  [570]                    [158]
Rung #188
                                                                                                     MOTOR 3
 |MOTOR 3                                                                                            SLOW STOP
 |SLOW                                                                                               PULSE
 |M3S                                                                                                M3SSP
 | O:013                                                                                             +--TON--------------+
 +---]/[---------------------------------------------------------------------------------------------|TIMER ON DELAY    |-(EN)-
      02                                                                                             |TIMER:      T4:263|
 [187]                                                                                               |BASE (SEC):   0.01|-(DN)
                                                                                                     |PRESET:        100|
                                                                                                     |ACCUM:         102|
                                                                                                     +-------------------+

T4:263.TT - — — - File #2 MAIN_PRGRM - 15-
```

Rung #189

```
| MOTOR 4        MOTOR START                                    MOTOR 4    |
| FAST PULSE     PULSE                                          INTERRUPT  |
| M4FP           MDPTB                                          M4I        |
|   T4:204         T4:299                                         O:012    |
|-+---| |---+------| |-------------------------------------------( )------|
| |   TT    |      DN                                              03     |
| |[190]    |    [12]                                                      |
| |MOTOR 4  |                                                              |
| |FAST STOP|                                                              |
| |PULSE    |                                                              |
| |M4FSP    |                                                              |
| | T4:224  |                                                              |
| |---| |---|                                                              |
| |   TT    |                                                              |
| |[191]    |                                                              |
| |MOTOR 4  |                                                              |
| |SLOW PULSE                                                              |
| |M4SP     |                                                              |
| |  T4:244 |                                                              |
| |---| |---|                                                              |
| |   TT    |                                                              |
| |[192]    |                                                              |
| |MOTOR 4  |                                                              |
| |SLOW STOP|                                                              |
| |PULSE    |                                                              |
| |M4SSP    |                                                              |
| | T4:264  |                                                              |
| +---| |---+                                                              |
|     TT                                                                   |
|  [193]                                                                   |
```

Rung #190



O:012/13 - -| |- - File #5 FAULTS - 1
-|/|- - File #2 MAIN_PRGRM - 191
-( )- - File #2 MAIN_PRGRM - 190
T4:204.TT - -| |- - File #2 MAIN_PRGRM - 189

Rung #191

T4:224.TT - -| |- - File #2 MAIN_PRGRM - 189

Rung #192

MANUAL MOTOR 4 ON MM4ON
N7:23
2
[514]

DOOR 2 OPEN DROP2S
I:006
03

PALLET DETECTED RIGHT SIDE LOADLOCK SEN6
I:003
05

PAUSE PALLET IN LLOCK MOTOR 4 M4PLL
B3
401
[628]

0:013/03 - -]/[- - File #2 MAIN_PRGRM - 193
T4:244.TT - -] [- - File #2 MAIN_PRGRM - 189

MOTOR 4 SLOW M4S
O:013
03

MOTOR 4 SLOW PULSE M4SP
TON
TIMER ON DELAY (EN)
TIMER: T4:244
BASE (SEC): 0.01 (DN)
PRESET: 100
ACCUM: 0

MOTOR 4 REVERSE M4R
B3
104
[571]

DOOR 1 OPEN DROP1S
I:006
01

PALLET DETECTED LEFT SIDE LOADLOCK SEN4
I:003
03

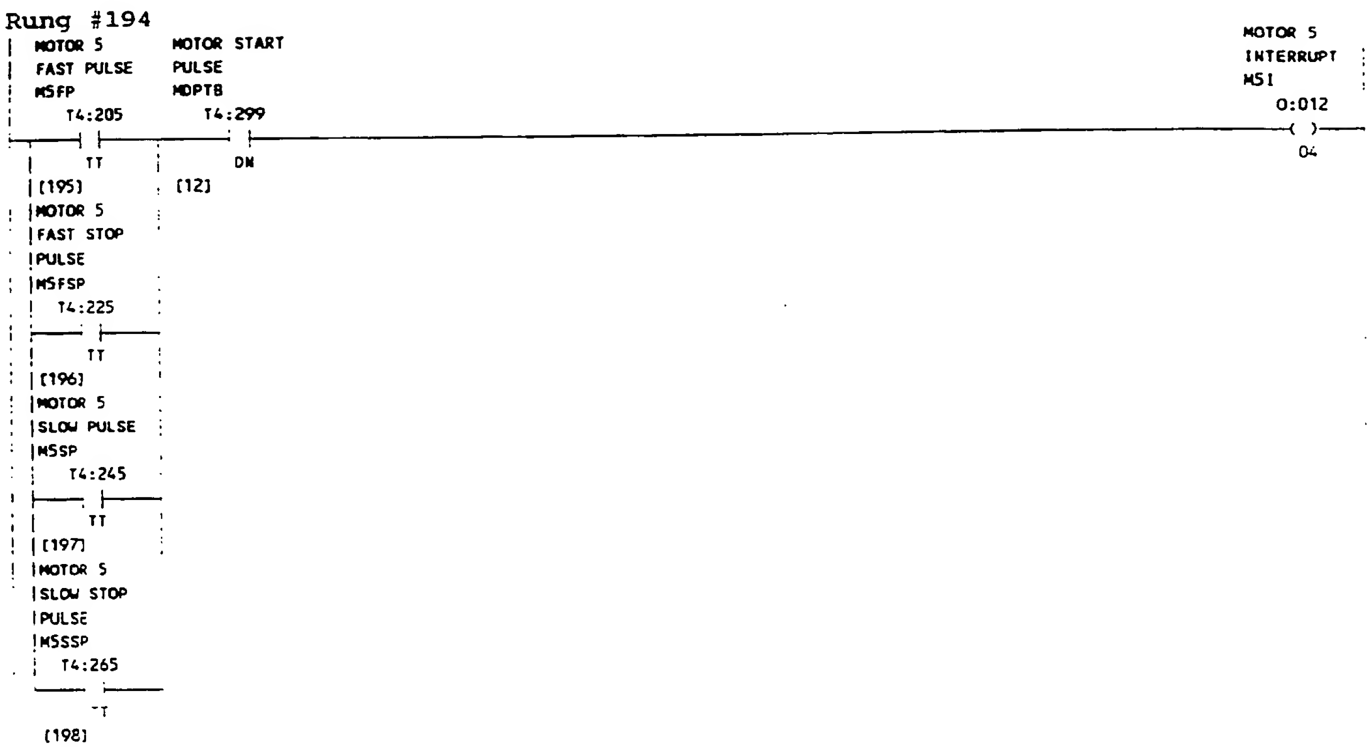
Rung #193

MOTOR 4 SLOW M4S
O:013
03
[192]

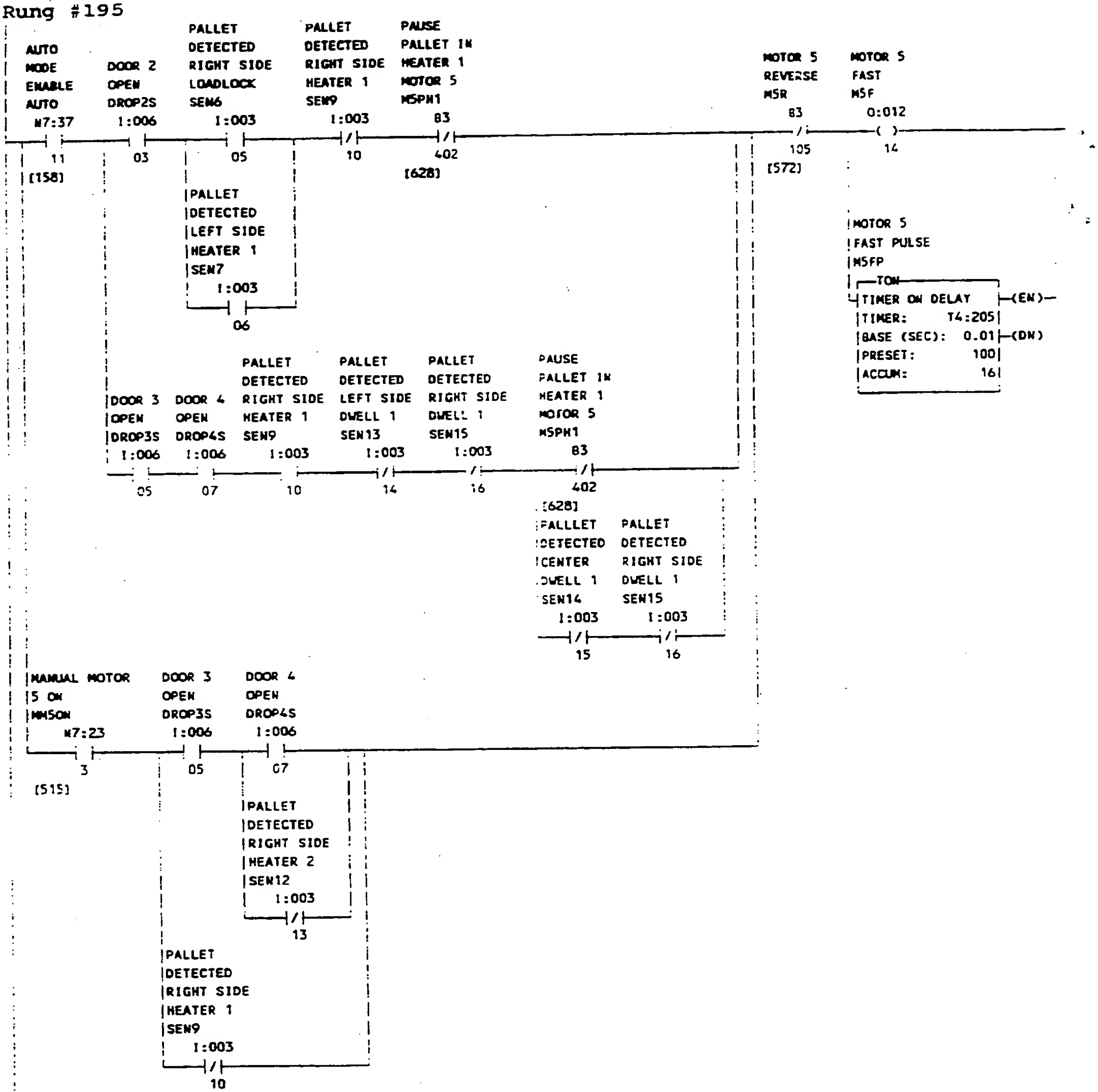
MOTOR 4 SLOW STOP PULSE M4SSP
TON
TIMER ON DELAY (EN)
TIMER: T4:264
BASE (SEC): 0.01 (DN)
PRESET: 100
ACCUM: 102

T4:264.TT - - - - File #2 MAIN_PRGRM - 189

231


Rung #194
MOTOR 5
FAST PULSE
MSFP
T4:205
TT
[195]
MOTOR START
PULSE
MOPTB
T4:299
DN
[12]
MOTOR 5
INTERRUPT
M5I
O:012
04
MOTOR 5
FAST STOP
PULSE
M5FSP
T4:225
TT
[196]
MOTOR 5
SLOW PULSE
M5SP
T4:245
TT
[197]
MOTOR 5
SLOW STOP
PULSE
M5SSP
T4:265
TT
[198]

Rung #195



O:012/14 - —| |— - File #5 FAULTS - 2
—|/|— - File #2 MAIN_PRGRM - 196
—( )— - File #2 MAIN_PRGRM - 195

T4:205.TT - — — - File #2 MAIN_PRGRM 194

Rung #196

MOTOR 5
FAST
M5F
O:012
—/—
14
[195]

MOTOR 5
FAST STOP
PULSE
M5FSP
TON
TIMER ON DELAY —(EN)—
TIMER: T4:225
BASE (SEC): 0.01 —(DN)
PRESET: 100
ACCUM: 0

T4:225.TT - — — - File #2 MAIN_PRGRM - 194

Rung #197

AUTO MODE ENABLE AUTO N7:37 11
DOOR 3 OPEN DROP3S I:006 05
DOOR 4 OPEN DROP4S I:006 07
PALLET DETECTED RIGHT SIDE HEATER 1 SEN9 I:003 10
PALLET DETECTED LEFT SIDE DWELL 1 SEN13 I:003 —/— 14
PALLET DETECTED RIGHT SIDE DWELL 1 SEN15 I:003 —/— 16
PAUSE PALLET IN HEATER 1 MOTOR 5 M5PH1 B3 —/— 402 [628]
MOTOR 5 SLOW M5S O:013 —( )— 04
[158]

PALLLET DETECTED CENTER DWELL 1 SEN14 I:003 —/— 15
PALLET DETECTED RIGHT SIDE DWELL 1 SEN15 I:003 —/— 16

MOTOR 5
SLOW PULSE
M5SP
TON
TIMER ON DELAY —(EN)—
TIMER: T4:245
BASE (SEC): 0.01 —(DN)
PRESET: 100
ACCUM: 0

MANUAL MOTOR 5 ON MM5ON N7:23 2
DOOR 3 OPEN DROP3S I:006 05
DOOR 4 OPEN DROP4S I:006 07
[515]

PALLET DETECTED RIGHT SIDE HEATER 2 SEN12 I:003 —/— 13

PALLET DETECTED RIGHT SIDE HEATER 1 SEN9 I:003 —/— 10

MOTOR 5 REVERSE M5R B3 105
DOOR 2 OPEN DROP2S I:006 03
[572]

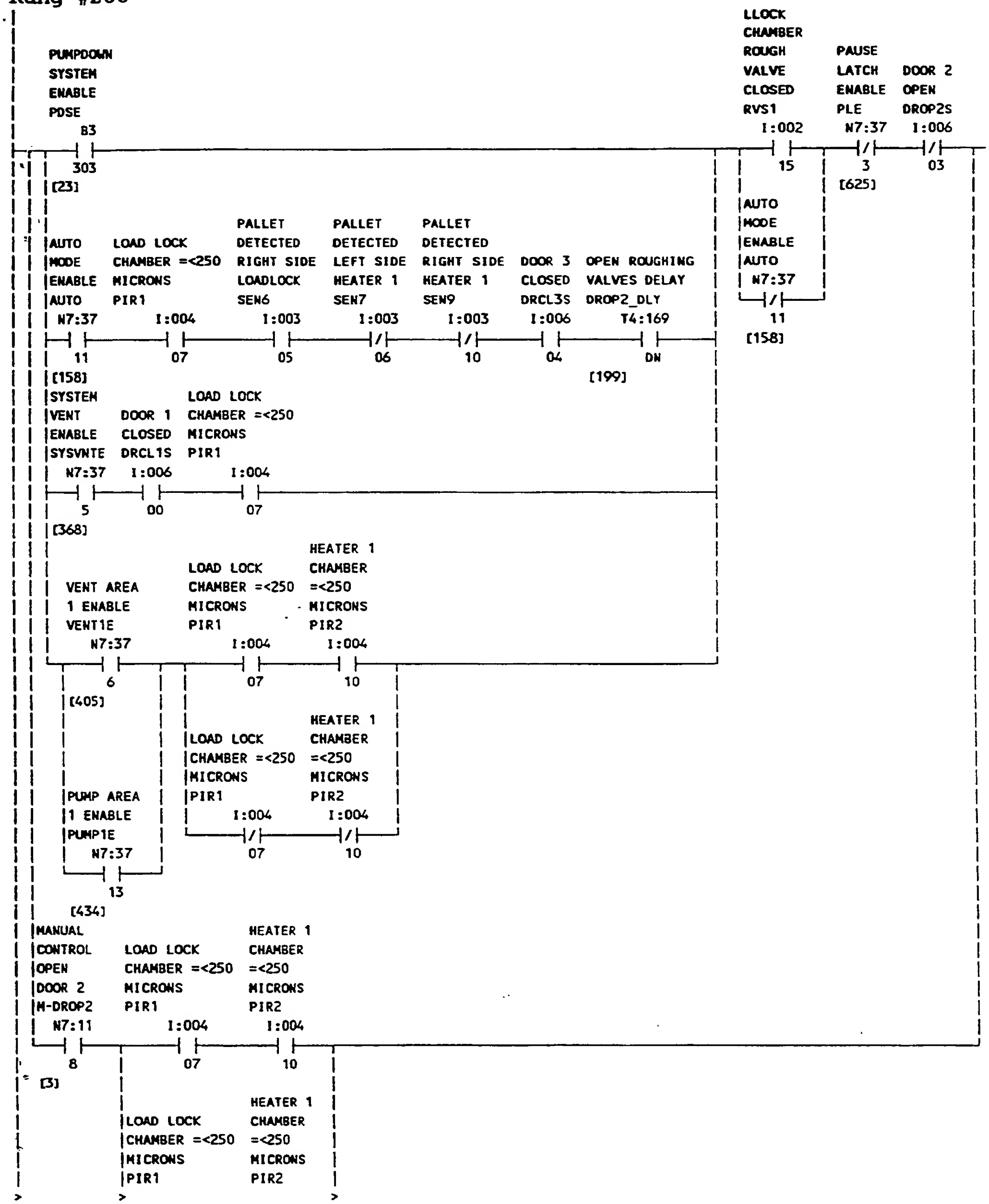
PALLET DETECTED LEFT SIDE HEATER 1 SEN7 I:003 —/—

BNSDOCID: <WO___9217621A1_I_>

```
                       06
O:013/04 - -|/|- - File #2 MAIN_PRGRM -  198
         -( )- - File #2 MAIN_PRGRM -  197
T4:265.TT - -| |- - File #2 MAIN_PRGRM -  194
Rung #198
|                                                        MOTOR 5
|MOTOR 5                                                 SLOW STOP
|SLOW                                                    PULSE
|M5S                                                     M5SSP
|  O:013                                                 --TON-------------
|--|/|---------------------------------------------------TIMER ON DELAY  -(EN)-
    04                                                   |TIMER:      T4:265|
|[197]                                                   |BASE (SEC):  0.01|-(DN)
|                                                        |PRESET:       100|
|                                                        |ACCUM:        102|
|                                                        -------------------
T4:265.TT - -| |- - File #2 MAIN_PRGRM -  194
Rung #199
|LLOCK
|CHAMBER
|ROUGH     AUTO
|VALVE     MODE                                          DOOR 2 OPEN
|CLOSED    ENABLE                                        DELAY
|RVS1      AUTO                                          DROP2_DLY
  I:002   N7:37                                          --TON-------------
|---| |-----| |------------------------------------------TIMER ON DELAY  -(EN)-
     15      11                                          TIMER:      T4:169
            [158]                                        BASE (SEC):  1.0-(DN)
                                                         PRESET:        2
                                                         ACCUM:         2
                                                         -------------------

T4:169.DN - -| |- - File #2 MAIN_PRGRM -  104,200
```

Rung #200


PUMPDOWN SYSTEM ENABLE PDSE
B3
303
[23]
LLOCK CHAMBER ROUGH VALVE CLOSED RVS1
I:002
15
PAUSE LATCH ENABLE PLE
N7:37
3
[625]
DOOR 2 OPEN DROP2S
I:006
03
AUTO MODE ENABLE AUTO
N7:37
11
[158]
AUTO MODE ENABLE AUTO
N7:37
11
[158]
LOAD LOCK CHAMBER =<250 MICRONS PIR1
I:004
07
PALLET DETECTED RIGHT SIDE LOADLOCK SEN6
I:003
05
PALLET DETECTED LEFT SIDE HEATER 1 SEN7
I:003
06
PALLET DETECTED RIGHT SIDE HEATER 1 SEN9
I:003
10
DOOR 3 CLOSED DRCL3S
I:006
04
OPEN ROUGHING VALVES DELAY DROP2_DLY
T4:169
DN
[199]
SYSTEM VENT ENABLE SYSVNTE
N7:37
5
[368]
DOOR 1 CLOSED DRCL1S
I:006
00
LOAD LOCK CHAMBER =<250 MICRONS PIR1
I:004
07
VENT AREA 1 ENABLE VENT1E
N7:37
6
[405]
LOAD LOCK CHAMBER =<250 MICRONS PIR1
I:004
07
HEATER 1 CHAMBER =<250 MICRONS PIR2
I:004
10
PUMP AREA 1 ENABLE PUMP1E
N7:37
13
[434]
LOAD LOCK CHAMBER =<250 MICRONS PIR1
I:004
07
HEATER 1 CHAMBER =<250 MICRONS PIR2
I:004
10
MANUAL CONTROL OPEN DOOR 2 M-DROP2
N7:11
8
[3]
LOAD LOCK CHAMBER =<250 MICRONS PIR1
I:004
07
HEATER 1 CHAMBER =<250 MICRONS PIR2
I:004
10
LOAD LOCK CHAMBER =<250 MICRONS PIR1
HEATER 1 CHAMBER =<250 MICRONS PIR2

```
     I:004      I:004
-----]/[--------]/[-----
      07         10

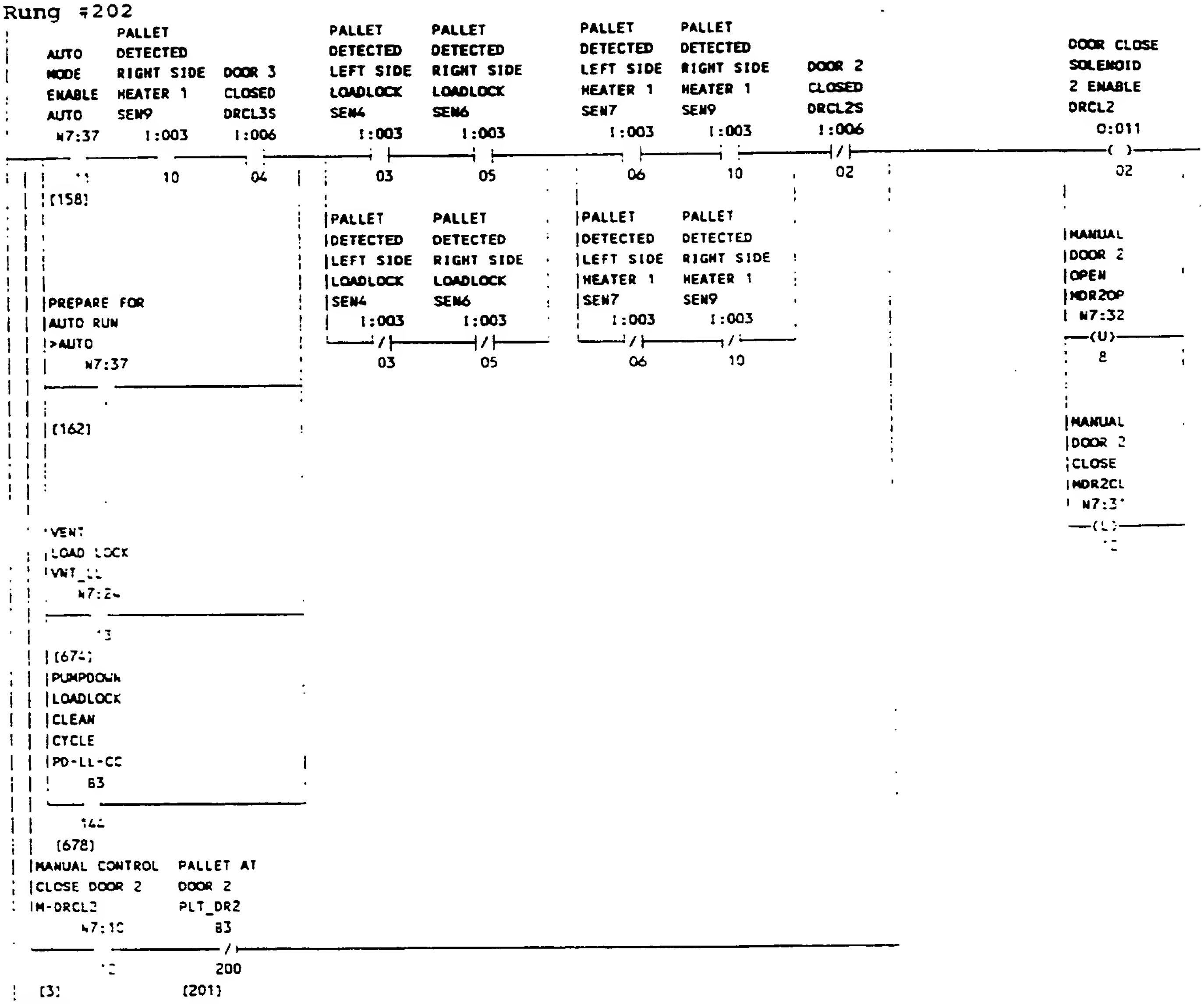
OPEN DOOR
SOLENOID
2 ENABLE
DROP2
   O:011
----( )------------------
    03
|MANUAL
|CONTROL  OPEN DOOR    MANUAL
|OPEN     SOLENOID     DOOR 2
|DOOR 2   2 ENABLE     OPEN
|M-DROP2  DROP2        MDR2OP
|  N7:11     O:011      N7:32
|---] [--------] [-------+--(L)----
     8           03      |   8
 [3]       [200)         |
                         |MANUAL
                         |DOOR 2
                         |CLOSE
                         |MDR2CL
                         | N7:31
                         +--(U)----
                             12
```

```
O:011/03 - -  - - File #2 MAIN_PRGRM -  200
                  File #5 FAULTS -  43
                  File #6 TECH_RUNGS -  2
         -( )- - File #2 MAIN_PRGRM -  200
N7:32/8 - -(L)- - File #2 MAIN_PRGRM -  200
         -(U)- - File #2 MAIN_PRGRM -  202
_F:N7:21[X21 - BTW - File #2 MAIN_PRGRM -  2
N7:31/12 - -(L)- - File #2 MAIN_PRGRM -  202
         -(U)- - File #2 MAIN_PRGRM -  200
_F:N7:21[X21 - BTW - File #2 MAIN_PRGRM -  2
```

Rung #201

```
|PALLET    PALLET      PALLET
|DETECTED  DETECTED    DETECTED
|CENTER    RIGHT SIDE  LEFT SIDE                    PALLET AT
|LOADLOCK  LOADLOCK    HEATER 1                     DOOR 2
|SENS      SEN6        SEN7                         PLT_DR2
|  I:003      I:003       I:003                        B3
|---] [--------] [---------] [-------------------------( )----
     04         05          06                          200
B3/200 - -/- - File #2 MAIN_PRGRM -  202
        -( )- - File #2 MAIN_PRGRM -  201
```

Rung #202



O:011/02 - — — - File #5 FAULTS - 19
File #6 TECH_RUNGS - 2
-( )- - File #2 MAIN_PRGRM - 202
N7:32/8 - -(L)- - File #2 MAIN_PRGRM - 200
-(U)- - File #2 MAIN_PRGRM - 202
_F:N7:211%2' - BTW - File #2 MAIN_PRGRM - 2
N7:31/12 - -(L)- - File #2 MAIN_PRGRM - 202
-(U)- - File #2 MAIN_PRGRM - 200
_F:N7:211%21 - BTW - File #2 MAIN_PRGRM - 2

```
Rung #203
|DOOR OPEN
|SOLENOID                                                          TEST COUNTER
|3 ENABLE                                                          TST_CNTR
|DROP3                                                             +-CTU--------+
|  0:011                                                           |COUNT UP    |-(CU)-
|---] [----------------------------------------------------------+|COUNTER: C5:0|
|    05                                                            |PRESET:    :|-(DN)
|[216]                                                             |ACCUM:    98:|
                                                                   +------------+

C5:0 - CTU - File #2 MAIN_PRGRM - 203
       RES - File #2 MAIN_PRGRM - 212
Rung #204
|          PALLET
|AUTO      DETECTED                                                  SENSOR 9
|MODE      RIGHT SIDE                                                LATCH
|ENABLE    HEATER 1                                                  SEN9_LTCH
|AUTO      SEN9                                                        B3
| N7:37     I:003
|---] [------] [--------------------------------------------------------(L)---
|   11        10                                                       329
|[158]
B3/329 - ] [ - File #2 MAIN_PRGRM - 206
        -(L)- - File #2 MAIN_PRGRM - 204
        -(U)- - File #2 MAIN_PRGRM - 205
Rung #205
|          PALLET      PALLET
|AUTO      DETECTED    DETECTED                                      SENSOR 9
|MODE      RIGHT SIDE  LEFT SIDE                                     LATCH
|ENABLE    HEATER 2    DWELL 1                                       SEN9_LTCH
|AUTO      SEN12       SEN13                                           B3
| N7:37     I:003       I:003
|---] [------] [----------] [-------------------------------------------(U)---
|   11        13          14                                           329
|[158]
B3/329 - ] [ - File #2 MAIN_PRGRM - 206
        -(L)- - File #2 MAIN_PRGRM - 204
        -(U)- - File #2 MAIN_PRGRM - 205
Rung #206
|AUTO                                                              CHART RECORDER
|MODE      SENSOR 9                                                COUNTER 1
|ENABLE    LATCH                                                   CHRTCNTR1
|AUTO      SEN9_LTCH                                               +-CTU--------+
| N7:37      B3                                                    |COUNT UP    |-(CU)-
|---] [------] [-------------------------------------------------+|COUNTER: C5:29|
|   11       329                                                   |PRESET:    :|-(DN)
|[158]     [205]                                                   |ACCUM:      |
|                                                                  +------------+
|
C5:29 - CTU - File #2 MAIN_PRGRM - 206
        RES - File #2 MAIN_PRGRM - 212
C5:29.ACC - NEQ - File #2 MAIN_PRGRM - 210
Rung #207
|          PALLET      PALLET
|AUTO      DETECTED    DETECTED                                      SENSOR 42
|MODE      CENTER      RIGHT SIDE                                    LATCH
|ENABLE    CARBON      CARBON                                        SEN42_LTCH
|AUTO      SEN41       SEN42                                           B3
| N7:37     I:053       I:053
|---] [------] [----------] [-------------------------------------------(L)---
|   11        01          02                                           330
|[158]
```

239

```
B3/330 - -| |- - File #2 MAIN_PRGRM    .09
        -(L)- - File #2 MAIN_PRGRM -  207
        -(U)- - File #2 MAIN_PRGRM -  208
Rung #208
        PALLET    PALLET
|AUTO   DETECTED  DETECTED
|MODE   CENTER    RIGHT SIDE                                   SENSOR 42
|ENABLE DWELL 6   DWELL 6                                      LATCH
|AUTO   SEN44     SEN45                                        SEN42_LTCH
 N7:37   I:053     I:053                                        B3
--| |------| |-------| |---------------------------------------(U)--
  11       04        05                                         330
 [158]
B3/330 - -| |- - File #2 MAIN_PRGRM -  209
        -(L)- - File #2 MAIN_PRGRM -  207
        -(U)- - File #2 MAIN_PRGRM -  208
Rung #209
|AUTO
|MODE   SENSOR 42                                  CHART RECORDER
|ENABLE LATCH                                      COUNTER 2
|AUTO   SEN42_LTCH                                 CHRTCNTR2
 N7:37      B3                                     --CTU----------
--| |------| |-------------------------------------COUNT UP     -(CU)-
  11        330                                    |COUNTER:  C5:30|
 [158]    [208]                                    PRESET:     0-(DN)
                                                   ACCUM:      96
                                                   ---------------

C5:30 - CTU - File #2 MAIN_PRGRM -  209
        RES - File #2 MAIN_PRGRM -  212
C5:30.ACC - NEQ - File #2 MAIN_PRGRM -  210
Rung #210
                                                   CHART RECORDER
                                                   1 ON
|CHRTCNTR1                                         CHRTRCD1
|--NEQ-----------------                               O:044
|NOT EQUAL (A<>B)      |--------------------------------( )--
||SOURCE A:  C5:29.ACC|                                 00
||                  98|
||SOURCE B:  C5:30.ACC|
|                   96|
 ----------------------                            CHART RECORDER
                                                   2 ON
C5:29.ACC - [212]                                  CHRTRCD2
C5:30.ACC - [209]                                     O:044
                                                   -----( )-----
                                                        01

Rung #211
                          PALLET
|AUTO                     DETECTED
|MODE   DOOR 2   DOOR 3   RIGHT SIDE               HEATER1
|ENABLE CLOSED   CLOSED   HEATER 1                 TIMER
|AUTO   DRCL2S   DRCL3S   SEN9                     HTR1TMR
 N7:37   I:006    I:006    I:003                   --TON----------
--| |-----| |------| |------| |---------------------TIMER ON DELAY  -(EN)-
  11      02       04       10                     |TIMER:     T4:74|
 [158]                                             |BASE (SEC):  1.0-(DN)
                                                   |PRESET:      60|
                                                   |ACCUM:        0|
                                                   ---------------

T4:74.DN - -| |- - File #2 MAIN_PRGRM -  214,226
T4:74.TT - -|/|- - File #2 MAIN_PRGRM -  213
```

```
Rung #212
|AUTO
|MODE                                                                    TEST COUNTER
|ENABLE                                                                  TST_CNTR
|AUTO                                                                         C5:0
| N7:37
|--|/|------------------------------------------------------------------------(RES)----|
|  11
|[158]
| C5:0 - CTU - File #2 MAIN_PRGRM - 203                                 |CHART RECORDER
| C5:29 - CTU - File #2 MAIN_PRGRM - 206                                |COUNTER 1
| C5:29.ACC - NEQ - File #2 MAIN_PRGRM - 210                            |CHRTCNTR1
| C5:30 - CTU - File #2 MAIN_PRGRM - 209                                      C5:29
| C5:30.ACC - NEQ - File #2 MAIN_PRGRM - 210                            |------(RES)------
|                                                                       |CHART RECORDER
|                                                                       |COUNTER 2
|                                                                       |CHRTCNTR2
|                                                                             C5:30
|                                                                       |------(RES)------

Rung #213
|          HEATER
|          SHIELD H2C                                                     SUBSTRATE
|          FLOW                                                           HEATER
|HEATER 1  GROUP 1                                                        SET HIGH
|TIMER     FAULT                                                          HH1A
|HTR1TMR   HSFG1F                                                           O:046
| T4:74        B3
|--| |---------|/|--------------------------------------------------------+----( )----|
|   TT         216                                                      |     00
|[211]      [5:190]                                                     |SUBSTRATE
| O:046/00 - -|/|- - File #2 MAIN_PRGRM - 153                           |HEATER
| O:046/01 - -|/|- - File #2 MAIN_PRGRM - 153                           |SET HIGH
| O:046/05 - -|/|- - File #2 MAIN_PRGRM - 153                           |HH1B
| O:046/06 - -|/|- - File #2 MAIN_PRGRM - 153                           |   O:046
|                                                                       +----( )----
|                                                                       |     01
|                                                                       |SUBSTRATE
|                                                                       |HEATER
|                                                                       |SET HIGH
|                                                                       |HH3A
|                                                                       |   O:046
|                                                                       +----( )----
|                                                                       |     05
|                                                                       |SUBSTRATE
|                                                                       |HEATER
|                                                                       |SET HIGH
|                                                                       |HH3B
|                                                                       |   O:046
|                                                                       +----( )----
|                                                                             06
```

Rung #214

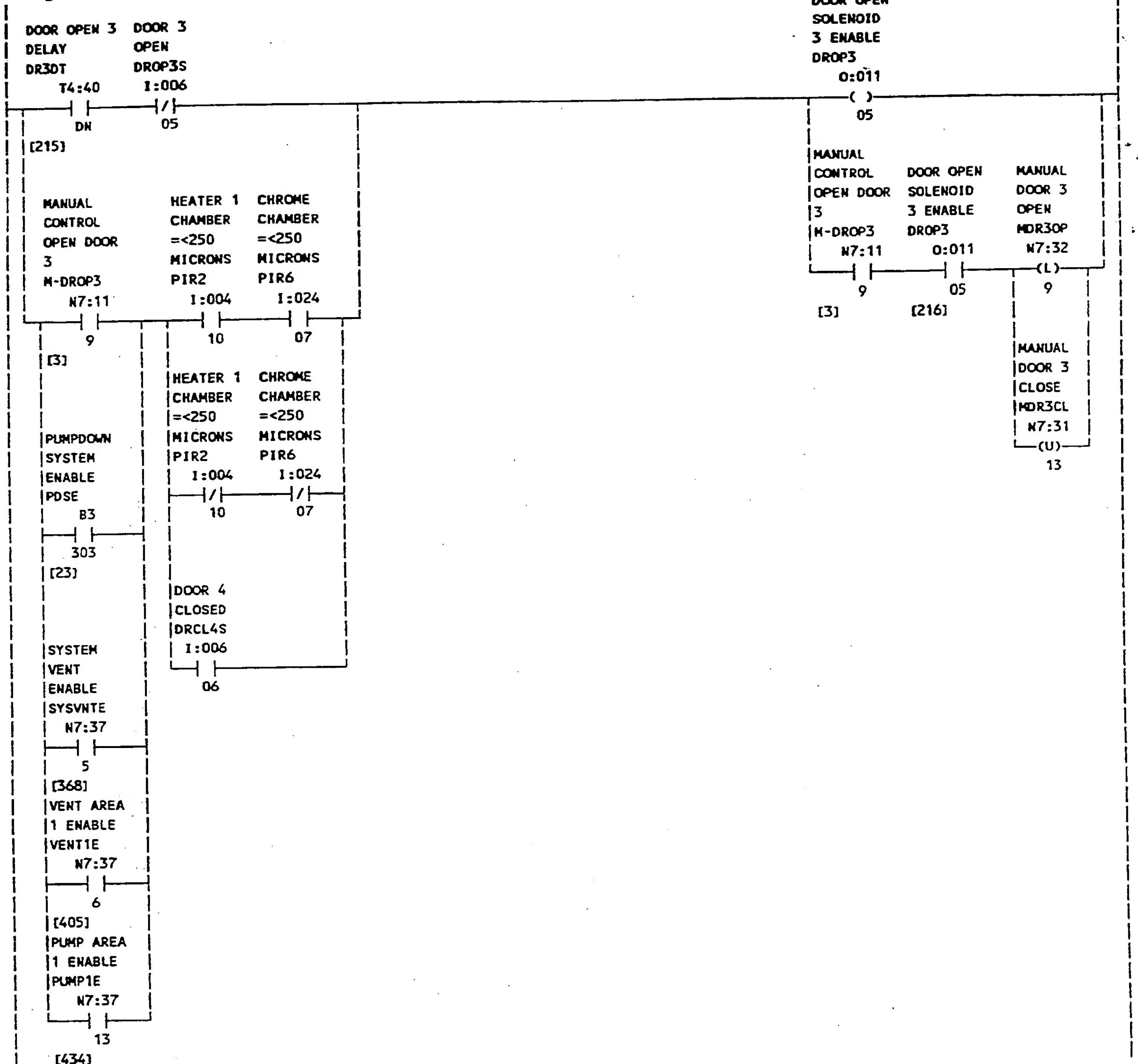
```
                  PALLET
AUTO              DETECTED                                    HEATER
MODE     HEATER 1 RIGHT SIDE                                  DELAY
ENABLE   COMPLETE DWELL 1                                     TIMER
AUTO     HTR1TMR  SEN15                                       HTRDLYTMR
 N7:37    T4:74    I:003                                      --TON----------------
--] [------] [------]/[-------------------------------------+-TIMER ON DELAY  -(EN)-
   11        DN       16                                      TIMER:      T4:75
 [158]     [211]                                              BASE (SEC): 1.0-(DN)
                                                              PRESET:       25
                                                              ACCUM:        0
```

T4:75.DN - —] [- File #2 MAIN_PRGRM - 215

Rung #215

```
                                        HEATER 1
                                        HIVAC BAFFLE
HTRDLYTMR                               HV1_2
 T4:75                                    O:011
--] [-------------------------------------(L)----------
   DN                                      12
 [214]
 O:011/12 - — ] [ - File #2 MAIN_PRGRM - 379
           —]/[ - File #2 MAIN_PRGRM - 38
           -(U)- - File #2 MAIN_PRGRM - 116
 T4:40.DN - —   — - File #2 MAIN_PRGRM - 216
                                         PAUSE
                                         LATCH        DOOR 3
                                         ENABLE       DELAY TIMER
                                         PLE          DR3DT
                                          N7:37       --TON-------------
                                       ----]/[--------TIMER ON DELAY  -(EN)-
                                            3         TIMER:     T4:40
                                          [625]       BASE (SEC): 1.0-(DN)
                                                      PRESET:      5
                                                      ACCUM:       0
                                         PALLET    PALLET
                                         DETECTED  DETECTED
                                         CENTER    RIGHT SIDE
                                         DWELL 1   DWELL 1
                                         SEN14     SEN15
                                          I:003     I:003
                                       ----]/[------]/[----
                                           15        16
```

Rung #216



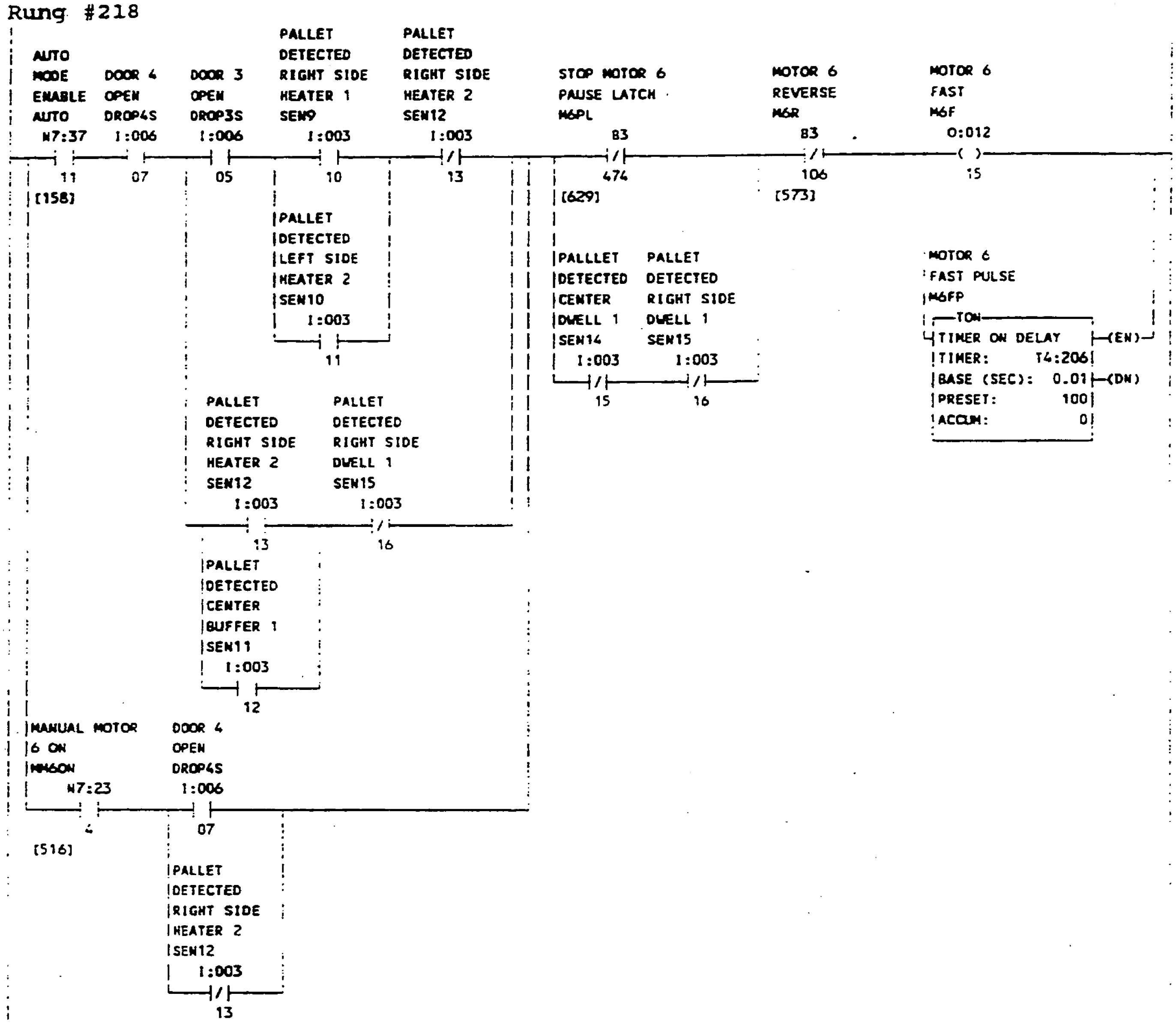
O:011/05 - -| |- - File #2 MAIN_PRGRM - 203
File #5 FAULTS - 45
File #6 TECH_RUNGS - 2
-( )- - File #2 MAIN_PRGRM - 216
N7:32/9 - -(L)- - File #2 MAIN_PRGRM - 216
-(U)- - File #2 MAIN_PRGRM - 229

```
_F:N7:211X21 - BTW - File #2 MAIN_PRG     -   2
N7:31/13 - -(L)- - File #2 MAIN_PRGRM -  229
           -(U)- - File #2 MAIN_PRGRM -  216
_F:N7:211X21 - BTW - File #2 MAIN_PRGRM -   2
```

Rung #217

```
| MOTOR 6       MOTOR DRIVE                                   MOTOR 6
| FAST PULSE    PULSER                                        INTERRUPT
| M6FP          MDP                                           M6I
|    T4:206        B3                                          O:012
|-----] [--------] [-------------------------------------------( )---
| |    TT   |     299                                            05
| |[218]    | [14]
| |MOTOR 6  |
| |FAST STOP|
| |PULSE    |
| |M6FSP    |
| | T4:226  |
| |---] [---|
| |    TT   |
| |[219]    |
| |MOTOR 6  |
| |SLOW PULSE
| |M6SP     |
| |  T4:246 |
| |---] [---|
| |    TT   |
| |[220]    |
| |MOTOR 6  |
| |SLOW STOP|
| |PULSE    |
| |M6SSP    |
| | T4:266  |
| |---] [---|
|      TT
|  [221]
```

Rung #218



O:012/15 - -] [- - File #5 FAULTS - 3
-]/[- - File #2 MAIN_PRGRM - 219
-( )- - File #2 MAIN_PRGRM - 218
T4:206.TT - -] [- - File #2 MAIN_PRGRM - 217

245

Rung #219

```
MOTOR 6                                             MOTOR 6
FAST                                                FAST STOP
M6F                                                 PULSE
 O:012                                              M6FSP
--|/|---------------------------------------------- TON
  15                                                TIMER ON DELAY      -(EN)-
[218]                                               TIMER:       T4:226
                                                    BASE (SEC):    0.01 -(DN)
                                                    PRESET:         100
                                                    ACCUM:          102
T4:226.TT - -| |- - File #2 MAIN_PRGRM -  217
```

Rung #220

```
 MANUAL MOTOR    DOOR 4                              MOTOR 6
 6 ON            OPEN                                SLOW
 MM6ON           DROP4S                              M6S
    N7:23         I:006                              O:013
------| |--------| |---------------------------------( )-
         4         07                                 05
 [516]
                 PALLET          O:013/05 - -|/|- - File #2 MAIN_PRGRM - 221
                 DETECTED        T4:246.TT - -| |- - File #2 MAIN_PRGRM - 217
                 RIGHT SIDE
                 HEATER 2                            MOTOR 6
                 SEN12                               SLOW PULSE
                    I:003                            M6SP
                 ---|/|---                           TON
                      13                             TIMER ON DELAY      -(EN)-
                                                     TIMER:       T4:246
                                                     BASE (SEC):    0.01 -(DN)
                                                     PRESET:         100
                                                     ACCUM:            0
 MOTOR 6      DOOR 3
 REVERSE      OPEN
 M6R          DROP3S
   B3          I:006
 ---| |--------| |---
    106        05
 [573]
              PALLET
              DETECTED
              LEFT SIDE
              HEATER 2
              SEN10
                 I:003
              ---|/|---
                   11
```

Rung #221

```
MOTOR 6                                             MOTOR 6
SLOW                                                SLOW STOP
M6S                                                 PULSE
 O:013                                              M6SSP
--|/|---------------------------------------------- TON
  05                                                TIMER ON DELAY      -(EN)-
[220]                                               TIMER:       T4:266
                                                    BASE (SEC):    0.01 -(DN)
                                                    PRESET:         100
                                                    ACCUM:          102
T4:266.TT - -| |- - File #2 MAIN_PRGRM -  217
```

```
Rung #222
|          PALLET                                                          HEATER 2
|AUTO      DETECTED                                                        DELAY OFF
|MODE      LEFT SIDE                                                       TIMER
|ENABLE    DWELL 1                                                         HTR2_OFF
|AUTO      SEN13                                                          +-TON----------------+
| N7:37      I:003                                                        |TIMER ON DELAY      |-(EN)-
|---] [------] [----------------------------------------------------------|TIMER:        T4:76|
|   11    |    14    |                                                    |BASE (SEC):    1.0|-(DN)
|[158]    |          |                                                    |PRESET:         13|
|         |PALLLET   | T4:76.DN - ] [ - File #2 MAIN_PRGRM - 223          |ACCUM:          13|
|         |DETECTED  |                                                    +--------------------+
|         |CENTER    |
|         |DWELL 1   |
|         |SEN14     |
|         |  I:003   |
|         |---] [----|
|         |    15    |
|         |PALLET    |
|         |DETECTED  |
|         |RIGHT SIDE|
|         |DWELL 1   |
|         |SEN15     |
|         |   I:003  |
|         +---] [----+
|             16
Rung #223
|                                                                          HEATER 2
|                                                                          LATCH
| HTR2_OFF                                                                 HTR2LTCH
|   T4:76                                                                     B3
|---+--] [-------------------------------------------------------------------(U)---
|   |   DN                   |                                               320
|   |[222]                   |
|   |                        | B3/320 - ] [ - File #2 MAIN_PRGRM - 225, 227
|   |                        |        -(L)- - File #2 MAIN_PRGRM - 224
|   |HSFFTMR                 |
|   |  T4:93                 |
|   |--] [-------------------|
|   |   DN                   |
|   |[S:199]                 |
|   |AUTO OFF                |
|   |PULSE                   |
|   |AUOFPULSE               |
|   |  T4:283                |
|   |---] [------------------|
|   |     TT                 |
|   |[155]                   |
|   |PALLET                  |
|   |DETECTED                |
|   |RIGHT SIDE  HEATER LATCH|
|   |DWELL 1     UNLATCH     |
|   |SEN15       HTR_UNLTCH  |
|   |  I:003         B3      |
|   +---] [--------[ONS]-----+
|       16          411
```

```
Rung #224
|                                                                                      HEATER 2  |
|                                                                                      LATCH     |
|HTR2ON_DY                                                                             HTR2LTCH  |
|  T4:78                                                                                 B3      |
|---] [------------------------------------------------------------------------------(L)-----|
|    DN                                                                                  320     |
|[226]                                                                                           |
B3/320 - ] [ - File #2 MAIN_PRGRM -  225,227
         -(L)- - File #2 MAIN_PRGRM -  224
         -(U)- - File #2 MAIN_PRGRM -  223
Rung #225
|HEATER 2                                                          HEATER 2 DRIVE               |
|LATCH                                                             FAULT TIMER                  |
|HTR2LTCH                                                          H2F                          |
|   B3                                                             +-TON--------------+         |
|---] [------------------------------------------------------------+TIMER ON DELAY    +-(EN)-|
|  320                                                             |TIMER:       T4:6|         |
|[224]                                                             |BASE (SEC):   1.0+-(DN)  |
|                                                                  |PRESET:        70|         |
|                                                                  |ACCUM:          0|         |
|                                                                  +------------------+         |
T4:6.DN - ]/[ - File #2 MAIN_PRGRM -  227
Rung #226
|                  HEATER                                                                       |
|                  SHIELD H2O                                                                   |
|AUTO              FLOW                                                                         |
|MODE    HEATER 1  GROUP 2                                         heater 2 on                  |
|ENABLE  COMPLETE  FAULT                                           delay                        |
|AUTO    HTR1TMR   HSFG2F                                          HTR2ON_DY                    |
| N7:37   T4:74      B3                                            +-TON--------------+         |
|---] [-----] [------]/[-------------------------------------------+TIMER ON DELAY    +-(EN)-|
|  11      DN       217                                            |TIMER:      T4:78|         |
|[158]   [211]    [5:191]                                          |BASE (SEC):   1.0+-(DN)  |
|                                                                  |PRESET:        26|         |
|                                                                  |ACCUM:          0|         |
|                                                                  +------------------+         |
T4:78.DN - ] [ - File #2 MAIN_PRGRM -  224
```

248

```
Rung #227
|                                                                SUBSTRATE
|HEATER 2  HEATER 2 DRIVE                                        HEATER
|LATCH     FAULT TIMER                                           SET HIGH
|HTR2LTCH  H2F                                                   HH2A
|  B3        T4:6                                                 O:046
|--] [--------]/[-------------------------------------------------+--( )--+
|  320        DN                                                  |  02   |
|[224]     [225]                                                  |       |
| O:046/02 - ]/[ - File #2 MAIN_PRGRM - 153                       |SUBSTRATE
| O:046/03 - ]/[ - File #2 MAIN_PRGRM - 153                       |HEATER
| O:046/04 - ]/[ - File #2 MAIN_PRGRM - 153                       |SET HIGH
| O:046/07 - ]/[ - File #2 MAIN_PRGRM - 153                       |HH2B
|                                                                 |  O:046
|                                                                 +--( )--+
|                                                                 |  03   |
|                                                                 |SUBSTRATE
|                                                                 |HEATER
|                                                                 |SET HIGH
|                                                                 |HH2C
|                                                                 |  O:046
|                                                                 +--( )--+
|                                                                 |  04   |
|                                                                 |SUBSTRATE
|                                                                 |HEATER
|                                                                 |SET HIGH
|                                                                 |HH3C
|                                                                 |  O:046
|                                                                 +--( )--+
|                                                                    07
Rung #228
|  PALLET      PALLET      PALLET
|  DETECTED    DETECTED    DETECTED
|  CENTER      RIGHT SIDE  LEFT SIDE                             PALLET AT
|  HEATER 1    HEATER 1    HEATER 2                              DOOR 3
|  SEN8        SEN9        SEN10                                 PLT_DR3
|   I:003       I:003       I:003                                  B3
|-+--] [--+------] [---------] [-------------------------------------( )--
| |  07   |      10          11                                     246
| |PALLET |  B3/246 - ]/[ - File #2 MAIN_PRGRM - 229
| |DETECTED
| |RIGHT SIDE
| |HEATER 2
| |SEN12  |
| |  I:003|
| +--] [--+
|    13
```

```
Rung #229
         PALLET     PALLET
AUTO     DETECTED   DETECTED
MODE     RIGHT SIDE LEFT SIDE        DOOR 3                                        CLOSE
ENABLE   HEATER 1   HEATER 2         CLOSED                                        DOOR 3
AUTO     SEN9       SEN10            DRCL3S                                        DRCL3
 N7:37    I:003      I:003            I:006                                        O:011
---] [-----]/[--------]/[--------------]/[-----------------------------------------( )---
    1       10         11               04                                           04
[158]
                                     O:011/04 - - - File #5 FAULTS - 21
                                                    File #6 TECH_RUNGS - 2
                  PALLET     PALLET  N7:32/9 - -(L)- - File #2 MAIN_PRGRM - 216   MANUAL
                  DETECTED   DETECTED _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2 DOOR 3
 VENT AREA        LEFT SIDE  RIGHT SIDE N7:31/13 - -(U)- - File #2 MAIN_PRGRM - 216 OPEN
 2 ENABLE         HEATER 1   HEATER 1 _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2 MDR3OP
 VENT2E           SEN7       SEN9                                                  N7:32
  N7:37            I:003      I:003                                              --(U)--
---] [-------------] [--------] [----                                                9
    7               06         10
[411]
                  PALLET     PALLET                                                MANUAL
                  DETECTED   DETECTED                                              DOOR 3
                  LEFT SIDE  RIGHT SIDE                                            CLOSE
                  HEATER 1   HEATER 1                                              MDR3CL
 PUMP AREA        SEN7       SEN9                                                  N7:31
 2 ENABLE          I:003      I:003                                              --(L)--
 PUMP2E         ----]/[--------]/[----                                              13
  N7:37             06         10
---] [---
    14
[438]
PREPARE FOR
AUTO RUN
>AUTO
  N7:37
---] [---
    1
[162]
MANUAL
CONTROL
CLOSE DOOR  PALLET AT
3           DOOR 3
M-DRCL3     PLT_DR3
 N7:10       B3
---] [-------]/[---------------------
    13       246
[3]         [228]
```

250

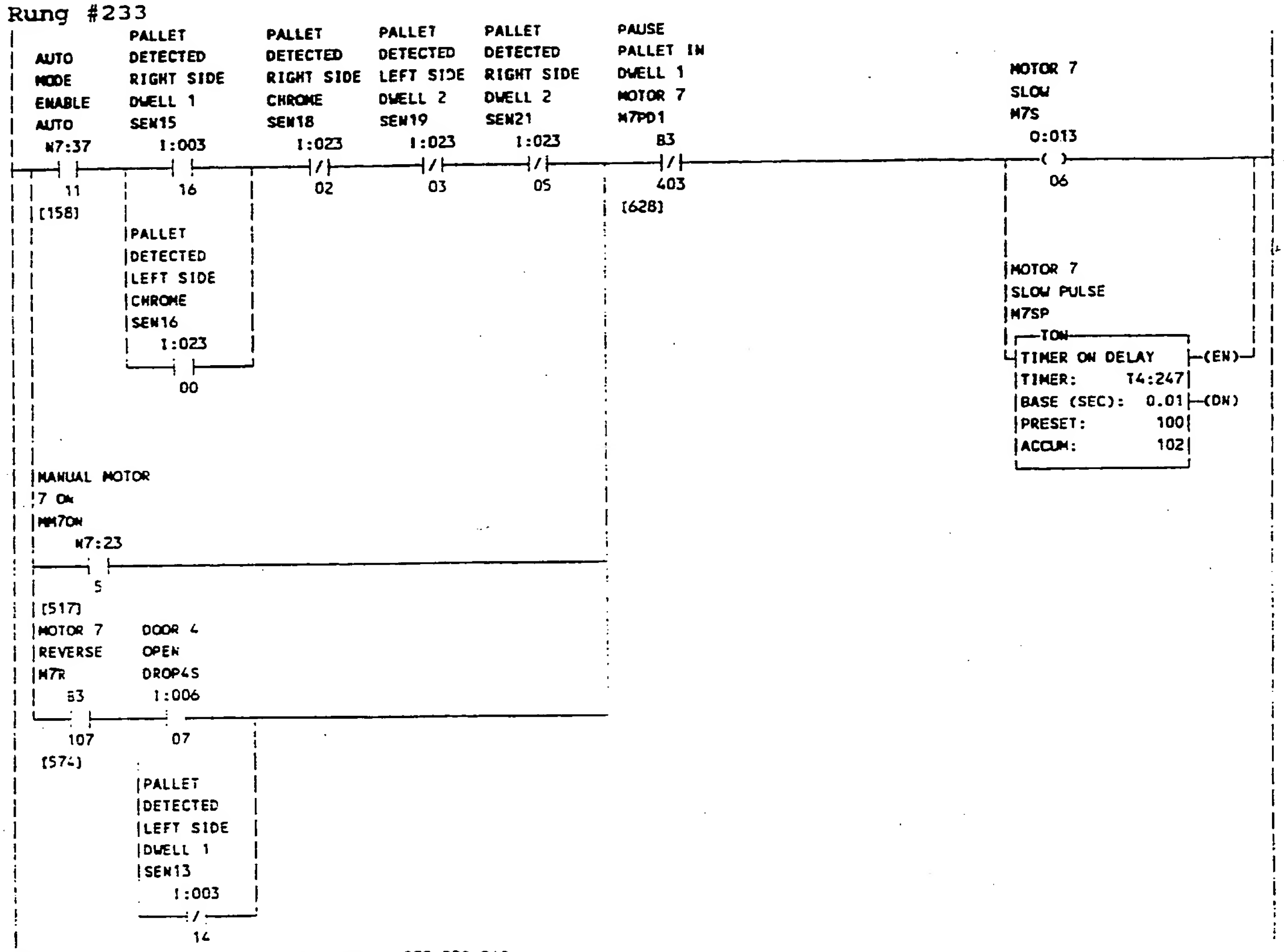
Rung #230

```
| MOTOR 7      MOTOR DRIVE                                   MOTOR 7   |
| FAST PULSE   PULSER                                        INTERRUPT |
| M7FP         MDP                                           M71       |
|   T4:207      B3                                             O:012   |
|----] [----+---] [------------------------------------------( )------|
| |   TT    |   299                                            06      |
| |[231]    |  [14]                                                    |
| |MOTOR 7  |                                                          |
| |FAST STOP|                                                          |
| |PULSE    |                                                          |
| |M7FSP    |                                                          |
| |  T4:227 |                                                          |
| |----] [--|                                                          |
| |   TT    |                                                          |
| |[232]    |                                                          |
| |MOTOR 7  |                                                          |
| |SLOW PULSE                                                          |
| |M7SP     |                                                          |
| |  T4:247 |                                                          |
| |----] [--|                                                          |
| |   TT    |                                                          |
| |[233]    |                                                          |
| |MOTOR 7  |                                                          |
| |SLOW STOP|                                                          |
| |PULSE    |                                                          |
| |M7SSP    |                                                          |
| |  T4:267 |                                                          |
| +----] [--+                                                          |
|     TT                                                               |
|  [234]                                                               |
```

```
Rung #231
|                           PALLET      PALLET      PAUSE
| AUTO                      DETECTED    DETECTED    PALLET IN
| MODE        DOOR 4        RIGHT SIDE  RIGHT SIDE  DWELL 1                       MOTOR 7              MOTOR 7
| ENABLE      OPEN          HEATER 2    DWELL 1     MOTOR 7                       REVERSE              FAST
| AUTO        DROP4S        SEN12       SEN15       M7PD1                         M7R                  M7F
| N7:37       I:006         I:003       I:003       B3                            B3                   O:012
|--| |-------| |-----------| |---------|/|---------|/|---------------------------|/|------------------( )--
|   11         07            13          16          403                           107                  16
| [158]                                             [628]                         [574]
|                           |PALLET
|                           |DETECTED
|                           |LEFT SIDE              |PALLLET     PALLET                              |MOTOR 7
|                           |DWELL 1                |DETECTED    DETECTED                            |FAST PULSE
|                           |SEN13                  |CENTER      RIGHT SIDE                          |M7FP
|                           |  I:003                |DWELL 1     DWELL 1                             |--TON--
|                           |---| |---              |SEN14       SEN15                               |TIMER ON DELAY  |-(EN)-
|                                14                 | I:003      I:003                               |TIMER:   T4:207|
|                                                   |--|/|-------|/|--                              |BASE (SEC): 0.01|-(DN)
|                                                       15         16                               |PRESET:      100|
|                                                                                                   |ACCUM:       102|
|            PALLET        PALLET       PALLET      PALLET       PAUSE
|            DETECTED      DETECTED     DETECTED    DETECTED     PALLET IN
|            RIGHT SIDE    RIGHT SIDE   LEFT SIDE   RIGHT SIDE   DWELL 1
|            DWELL 1       CHROME       DWELL 2     DWELL 2      MOTOR 7
|            SEN15         SEN18        SEN19       SEN21        M7PD1
|              I:003        I:023        I:023       I:023        B3
|          |----| |-------|--|/|--------|/|---------|/|---------|/|---
|                16         02           03          05          403
|                                                                 [628]
|           |PALLET
|           |DETECTED
|           |LEFT SIDE
|           |CHROME
|           |SEN16
|           |  I:023
|           |---| |---
|                00
| |MANUAL MOTOR
| |7 ON
| |MM7ON
| |   N7:23
| |---| |-----------------------------------------------------------------
|      5
| [517]
O:012/16 - -| |- - File #5 FAULTS -  3
           -|/|- - File #2 MAIN_PRGRM -  232
           -( )- - File #2 MAIN_PRGRM -  231
T4:207.TT - -| |- - File #2 MAIN_PRGRM -  230
Rung #232
|                                                                            MOTOR 7
|MOTOR 7                                                                     FAST STOP
|FAST                                                                        PULSE
|M7F                                                                         M7FSP
| O:012                                                                      --TON--
|--|/|-----------------------------------------------------------------------|TIMER ON DELAY  |-(EN)-
|  16                                                                        |TIMER:   T4:227|
|[231]                                                                       |BASE (SEC): 0.01|-(DN)
|                                                                            |PRESET:      100|
|                                                                            |ACCUM:         0|
T4:227.TT - -| |- - File #2 MAIN_PRGRM -  230
```

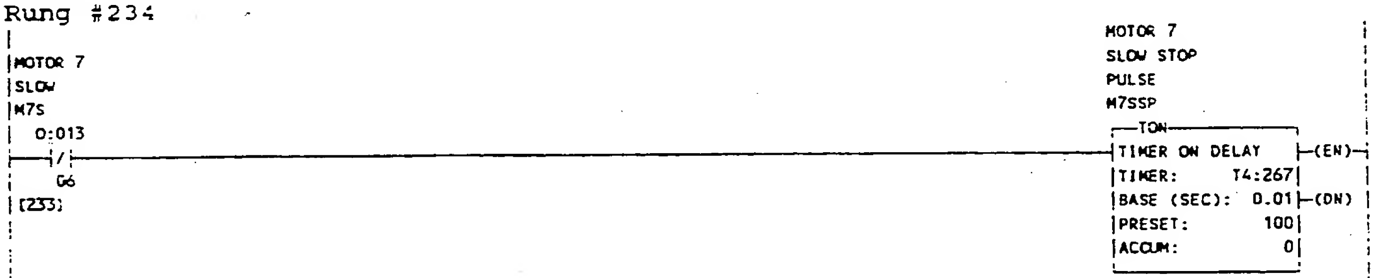
252

Rung #233



O:013/06 - —] [- - File #2 MAIN_PRGRM - 235,238,249
—]/[— - File #2 MAIN_PRGRM - 234
—( )— - File #2 MAIN_PRGRM - 233
T4:247.TT - —] [- - File #2 MAIN_PRGRM - 230

Rung #234



T4:267.TT - —] [- - File #2 MAIN_PRGRM - 230

253

Rung #235

```
|                     PALLLET  PALLET      PALLET                                   CHROME HI       |
|AUTO                 DETECTED DETECTED    DETECTED                                 POWER           |
|MODE      MOTOR 7    CENTER   RIGHT SIDE  LEFT SIDE                                SECT 1 & 2      |
|ENABLE    SLOW       DWELL 1  DWELL 1     CHROME     CHROME WATER OK               LATCHED         |
|AUTO      N7S        SEN14    SEN15       SEN16      CHR-OK                        HIPRCHR1,2-LAT  |
| N7:37    O:013      I:003    I:003       I:023      B3                            B3              |
|--| |------| |------| |------| |---------|/|--------| |------------------------------(L)------------|
|  11        06        15       16          00         277                          269             |
|[158]     [233]                                   [725]                                            |
B3/269 - -| |- - File #2 MAIN_PRGRM - 236
         -(L)- - File #2 MAIN_PRGRM - 235
         -(U)- - File #2 MAIN_PRGRM - 237
```

Rung #236

```
|CHROME HI                                                                  CHROME            |
|POWER                                                                      HI POWER          |
|SECT 1 & 2                                                                 SUPPLY 1          |
|LATCHED           CHROME WATER OK                                          OUTPUT            |
|HIPRCHR1,2-LAT    CHR-OK                                                   CHRPS1            |
|       B3             B3                                                    O:033            |
|------| |-------------| |----------------------------------------------+------( )-------+----|
|       269            277                                              |     10         |    |
|[235]             [725]                                                |                |    |
|                                                                       |CHROME          |    |
| O:033/10 - -| |- - File #6 TECH_RUNGS - 6                             |HI POWER        |    |
| B3/831 - - -| |- - File #2 MAIN_PRGRM - 620, 622                      |SUPPLY 2        |    |
|                                                                       |OUTPUT          |    |
|                                                                       |CHRPS2          |    |
|                                                                       | O:033          |    |
|                                                                       +------( )-------+    |
|                                                                       |     11         |    |
|                                                                       |HIGH POWER      |    |
|                                                                       |CHROME 1 & 2    |    |
|                                                                       |TO THE FIX      |    |
|                                                                       |HIPRCH1,2       |    |
|                                                                       |      B3        |    |
|                                                                       +------( )-------+    |
|                                                                            831              |
```

Rung #237

```
|          PALLET    PALLET       PALLET                                    CHROME HI        |
|  AUTO    DETECTED  DETECTED     DETECTED                                  POWER            |
|  MODE    CENTER    RIGHT SIDE   LEFT SIDE                                 SECT 1 & 2       |
|  ENABLE  CHROME    CHROME       DWELL 2                                   LATCHED          |
|  AUTO    SEN17     SEN18        SEN19                                     HIPRCHR1,2-LAT   |
|   N7:37   I:023     I:023        I:023                                    B3               |
|-+--| |-----|/|-------| |---------| |---+---------------------------------(U)--------------|
| |  11       01       02           03   |                                  269              |
| |[158]                                 |                                                   |
| |                                      | B3/269 - -| |- - File #2 MAIN_PRGRM - 236        |
| |                                      |        -(L)- - File #2 MAIN_PRGRM - 235         |
| |CHROME WATER OK                       |                                                   |
| |CHR-OK                                |                                                   |
| |        B3                            |                                                   |
| +-------|/|----------------------------+                                                   |
| |        277                           |                                                   |
| |[725]                                 |                                                   |
| |AUTO OFF                              |                                                   |
| |PULSE                                 |                                                   |
| |AUOFPULSE                             |                                                   |
| |  T4:283                              |                                                   |
| +------| |-----------------------------+                                                   |
|        TT                                                                                  |
|  [155]                                                                                     |
```

254

```
Rung #238
|                                                                                          TURN ON CHROME
|                                 PALLET      PALLET                                       HI POWER TO
|AUTO                             DETECTED    DETECTED                                     SECT 3 & 4
|MODE       MOTOR 7   MOTOR 8     RIGHT SIDE  LEFT SIDE                                    TIMER DELAY
|ENABLE     SLOW      FAST        DWELL 1     CHROME      CHROME WATER OK                  LATCH
|AUTO       M7S       M8F         SEN15       SEN16       CHR-OK                           HIPRCHR-3,4-LAT
| N7:37     O:013     O:012       I:003       I:023         B3                                 B3
|-] [-------] [-------] [---------] [---------] [-----------] [----------------------------------(L)--
|  11        06        17          16          00            277                               263
|[158]     [233]     [249]                               [725]
B3/263 - ] [ - File #2 MAIN_PRGRM - 239
         -(L)- - File #2 MAIN_PRGRM - 238
         -(U)- - File #2 MAIN_PRGRM - 240
Rung #239
|TURN ON CHROME                                                              READY TO TURN
|HI POWER TO                                                                 HI POWER TO
|SECT 3 & 4                                                                  CHROME SECT 3
|TIMER DELAY                                                                 & 4 WHEN PALLET
|LATCH                                                                       @ LEFT SIDE CHR
|HIPRCHR-3,4-LAT                                                             HIPRCHR-3,4-DLY
|        B3                                                                  +--TON-------------+
|--------] [-----------------------------------------------------------------+TIMER ON DELAY    +-(EN)-
|        263                                                                 |TIMER:    T4:300|
|[238]                                                                       |BASE (SEC):  0.01+-(DN)
|                                                                            |PRESET:       300|
|                                                                            |ACCUM:          0|
|                                                                            +------------------+
T4:300.DN - ] [ - File #2 MAIN_PRGRM - 240,241
Rung #240
|                                                                                  TURN ON CHROME
| READY TO TURN                                                                    HI POWER TO
| HI POWER TO                                                                      SECT 3 & 4
| CHROME SECT 3                                                                    TIMER DELAY
| & 4                                                                              LATCH
| HIPRCHR-3,4-DLY                                                                  HIPRCHR-3,4-LAT
|        T4:300                                                                         B3
|-+---------] [-------+-------------------------------------------------------------------(U)------
| |         DN        |                                                                 263
| |[239]              |
| |                   | B3/263 - ] [ - File #2 MAIN_PRGRM - 239
| |                   |          -(L)- - File #2 MAIN_PRGRM - 238
| |CHROME WATER OK    |
| |CHR-OK             |
| |        B3         |
| +--------]/[--------+
| |        277        |
| |[725]              |
| |AUTO OFF           |
| |PULSE              |
| |AUOFPULSE          |
| |  T4:283           |
| +--------] [--------+
|          TT
| [155]
```

Rung #241

READY TO TURN HI POWER TO CHROME SECT 3 & 4
HIPRCHR-3,4-DLY
T4:300
DN
[239]

HI POWER TO CHROME SECT 3 & 4 LATCHED
HIPRCHR3,4-LAT
B3
-(L)-
266

B3/266 - ┤ ├ - File #2 MAIN_PRGRM - 242
-(L)- - File #2 MAIN_PRGRM - 241
-(U)- - File #2 MAIN_PRGRM - 243

Rung #242

HI POWER TO CHROME SECT 3 & 4 LATCHED
HIPRCHR3,4-LAT
B3
266
[241]

CHROME WATER OK
CHR-OK
B3
277
[725]

CHROME HI POWER SUPPLY 3 OUTPUT
CHRPS3
O:033
-( )-
12

CHROME HI POWER SUPPLY 4 OUTPUT
CHRPS4
O:033
-( )-
13

HIGH POWER CHROME 3 & 4 TO THE FIX
HIPRCHR3,4
B3
-( )-
832

O:033/12 - ┤ ├ - File #6 TECH_RUNGS - 6
B3/832 - ┤ ├ - File #2 MAIN_PRGRM - 620, 622

Rung #243

AUTO MODE ENABLE AUTO
N7:37
11
[158]

PALLET DETECTED CENTER DWELL 2
SEN20
I:023
04

PALLET DETECTED RIGHT SIDE DWELL 2
SEN21
I:023
05

CHROME WATER OK
CHR-OK
B3
-|/|-
277
[725]

AUTO OFF PULSE
AUOFPULSE
T4:283
TT
[155]

HI POWER TO CHROME SECT 3 & 4 LATCHED
HIPRCHR3,4-LAT
B3
-(U)-
266

B3/266 - ┤ ├ - File #2 MAIN_PRGRM - 242
-(L)- - File #2 MAIN_PRGRM - 241

```
Rung #244
|PALLET      PALLET
|DETECTED    DETECTED
|LEFT SIDE   RIGHT SIDE
|HEATER 2    HEATER 2                                              CHROME TIMER
|SEN10       SEN12                                                 CHR_TMR
|  I:003       I:003                                                  T4:71
|---] [---------] [---------------------------------------------------(RES)----|
|    11          13
T4:71 - RTO - File #2 MAIN_PRGRM -  246
        RES - File #2 MAIN_PRGRM -  244
Rung #245
|PALLET      PALLLET   PALLET
|DETECTED    DETECTED  DETECTED
|LEFT SIDE   CENTER    RIGHT SIDE
|DWELL 1     DWELL 1   DWELL 1                                     CHROME COUNTER
|SEN13       SEN14     SEN15                                       CHR_CNT
|  I:003       I:003      I:003                                        B3
|---] [---------] [--------] [-----------------------------------------(L)-----|
|    14          15         16                                         90
B3/90 - ] [ - File #2 MAIN_PRGRM -  246
        -(L)- - File #2 MAIN_PRGRM -  245
        -(U)- - File #2 MAIN_PRGRM -  247
Rung #246
|CHROME COUNTER                                        CHROME TIMER
|CHR_CNT                                               CHR_TMR
|     B3                                               +-RTO-------------+
|----] [-----------------------------------------------|RETENTIVE TIMER ON|-(EN)-
|     90                                               |TIMER:      T4:71|
|[245]                                                 |BASE (SEC):   1.0|-(DN)
|                                                      |PRESET:      1000|
|                                                      |ACCUM:          2|
|                                                      +-----------------+
T4:71 - RTO - File #2 MAIN_PRGRM -  246
        RES - File #2 MAIN_PRGRM -  244
Rung #247
|PALLET      PALLET    PALLET
|DETECTED    DETECTED  DETECTED
|LEFT SIDE   CENTER    RIGHT SIDE
|DWELL 2     DWELL 2   DWELL 2                                     CHROME COUNTER
|SEN19       SEN20     SEN21                                       CHR_CNT
|  I:023       I:023      I:023                                        B3
|---] [---------] [--------] [-----------------------------------------(U)-----
|    03          04         05                                         90
B3/90 - ] [ - File #2 MAIN_PRGRM -  246
        -(L)- - File #2 MAIN_PRGRM -  245
        -(U)- - File #2 MAIN_PRGRM -  247
```

Rung #248

```
| MOTOR 8        MOTOR DRIVE                                  MOTOR 8   |
| SLOW PULSE     PULSER                                       INTERRUPT |
| M8FP           MDP                                          M8I       |
|    T4:208          B3                                         O:012   |
|-+----] [----+-----] [-----------------------------------------( )----|
| |    TT     |     299                                          07     |
| |[249]      | [14]                                                    |
| |MOTOR 8    |                                                         |
| |FAST STOP  |                                                         |
| |PULSE      |                                                         |
| |M8FSP      |                                                         |
| |  T4:228   |                                                         |
| +----] [----+                                                         |
| |    TT     |                                                         |
| |[250]      |                                                         |
| |MOTOR 8    |                                                         |
| |SLOW STOP  |                                                         |
| |PULSE      |                                                         |
| |M8SSP      |                                                         |
| |  T4:268   |                                                         |
| +----] [----+                                                         |
|      TT                                                               |
| [251]
```

Rung #249

```
     AUTO      PALLET          MOTOR 7   PALLET                          MOTOR 8   MOTOR 8
     MODE      DETECTED        SLOW      DETECTED                        REVERSE   FAST
     ENABLE    RIGHT SIDE      M7S       RIGHT SIDE                      M8R       M8F
     AUTO      DWELL 1         0:013     DWELL 2                         B3        0:012
     N7:37     SEN15                     SEN21
               I:003                     I:023
|---] [-------] [-------+----] [----+----]/[-----------------------------+--]/[------( )----+--
     11         16       |   06      |    05                              108        17
    [158]                | [233]     |                                   [575]
               PALLET    |           |                                 MOTOR 8
               DETECTED  |  MOTOR 9  |                                 SLOW
               LEFT SIDE |  SLOW     |                                 M8S
               CHROME    |  M9S      |                                  0:013
               SEN16     |  0:033    |                                +----( )----------+
               I:023     +----] [----+                                    07
              +--] [-----+    00                                       MOTOR 8
                 00          [255]                                     FAST PULSE
               PALLET                                                  M8FP
               DETECTED                                               +-TON--------------+
               RIGHT SIDE                                             |TIMER ON DELAY    |-(EN)-
               CHROME                                                 |TIMER:     T4:208 |
               SEN18                                                  |BASE (SEC):  0.01 |-(DN)
               I:023                                                  |PRESET:       100 |
              +--] [-----+                                            |ACCUM:        102 |
                 02                                                   +------------------+
    MANUAL MOTOR
    8 ON
    MM8ON
     N7:23
   +---] [------------------------+
        6
    [518]
    MOTOR 8
    REVERSE
    M8R
     B3
   +---] [------------------------+
       108
    [575]
```

```
0:012/17 - --] [-- - File #2 MAIN_PRGRM -  238
                     File #5 FAULTS -  4
           --]/[-- - File #2 MAIN_PRGRM -  250
           --( )-- - File #2 MAIN_PRGRM -  249
0:013/07 - --]/[-- - File #2 MAIN_PRGRM -  251
           --( )-- - File #2 MAIN_PRGRM -  249
T4:208.TT - --] [-- - File #2 MAIN_PRGRM -  248
```

Rung #250

```
MOTOR 8                                                   MOTOR 8
FAST                                                      FAST STOP
M8F                                                       PULSE
 0:012                                                    M8FSP
                                                         +-TON--------------+
|---]/[--------------------------------------------------|TIMER ON DELAY    |-(EN)-
     17                                                  |TIMER:     T4:228 |
[249]                                                    |BASE (SEC):  0.01 |-(DN)
                                                         |PRESET:       100 |
                                                         |ACCUM:          0 |
                                                         +------------------+
```

T4:228.TT - ⊣ ⊢ - File #2 MAIN_PRC 248

Rung #251

MOTOR 8 SLOW M8S 0:013 —|/|— 07 [249]

MOTOR 8 SLOW STOP PULSE M8SSP

TON
TIMER ON DELAY —(EN)—
TIMER: T4:268
BASE (SEC): 0.01 —(DN)
PRESET: 100
ACCUM: 0

T4:268.TT - ⊣ ⊢ - File #2 MAIN_PRGRM - 248

Rung #252

MOTOR 9 FAST PULSE M9FP T4:209 —| |— TT [253]

MOTOR DRIVE PULSER MDP B3 —| |— 299 [14]

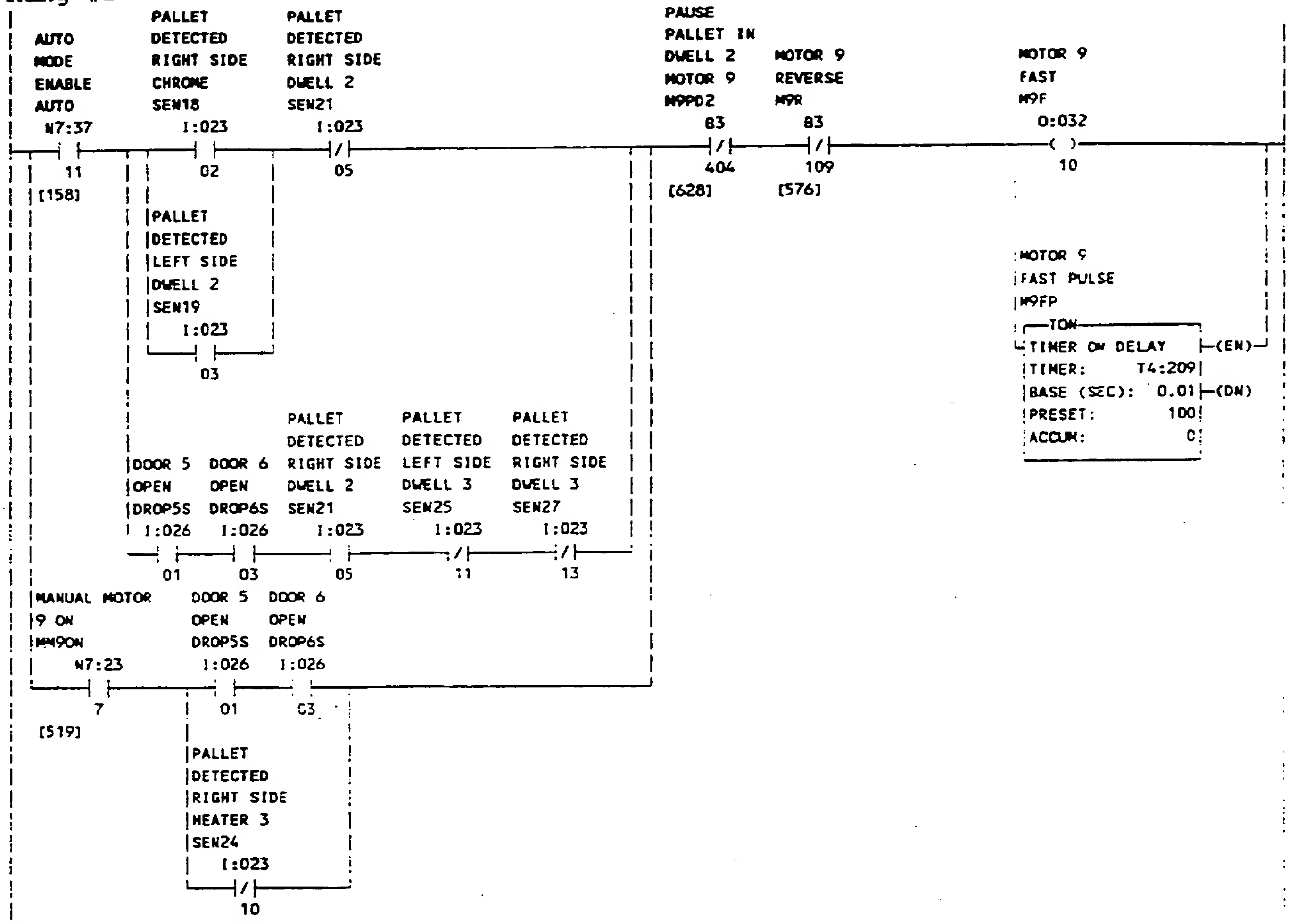
MOTOR 9 INTERRUPT M9I 0:032 —( )— 00

MOTOR 9 FAST STOP PULSE M9FSP T4:229 —| |— TT [254]

MOTOR 9 SLOW PULSE M9SP T4:249 —| |— TT [255]

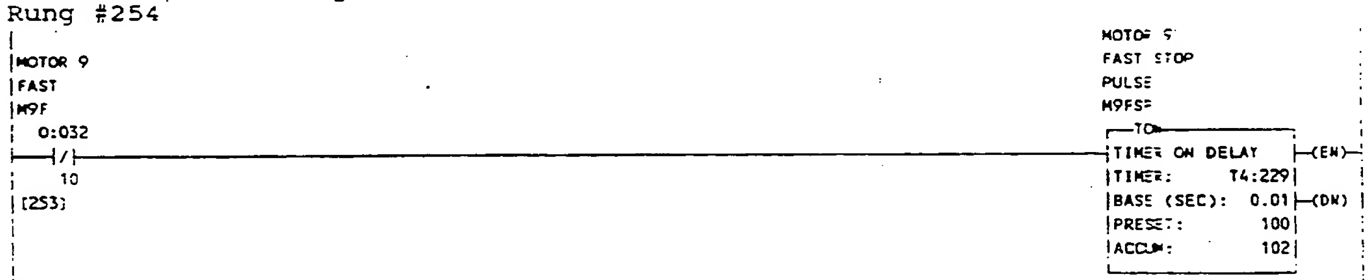
MOTOR 9 SLOW STOP PULSE M9SSP T4:269 —| |— TT [256]

Rung #253



O:032/10 - -| |- - File #5 FAULTS - 5
-|/|- - File #2 MAIN_PRGRM - 254
-( )- - File #2 MAIN_PRGRM - 253
T4:209.TT - -| |- - File #2 MAIN_PRGRM - 252

Rung #254



T4:229.TT - -| |- - File #2 MAIN_PRGRM - 252

Rung #255

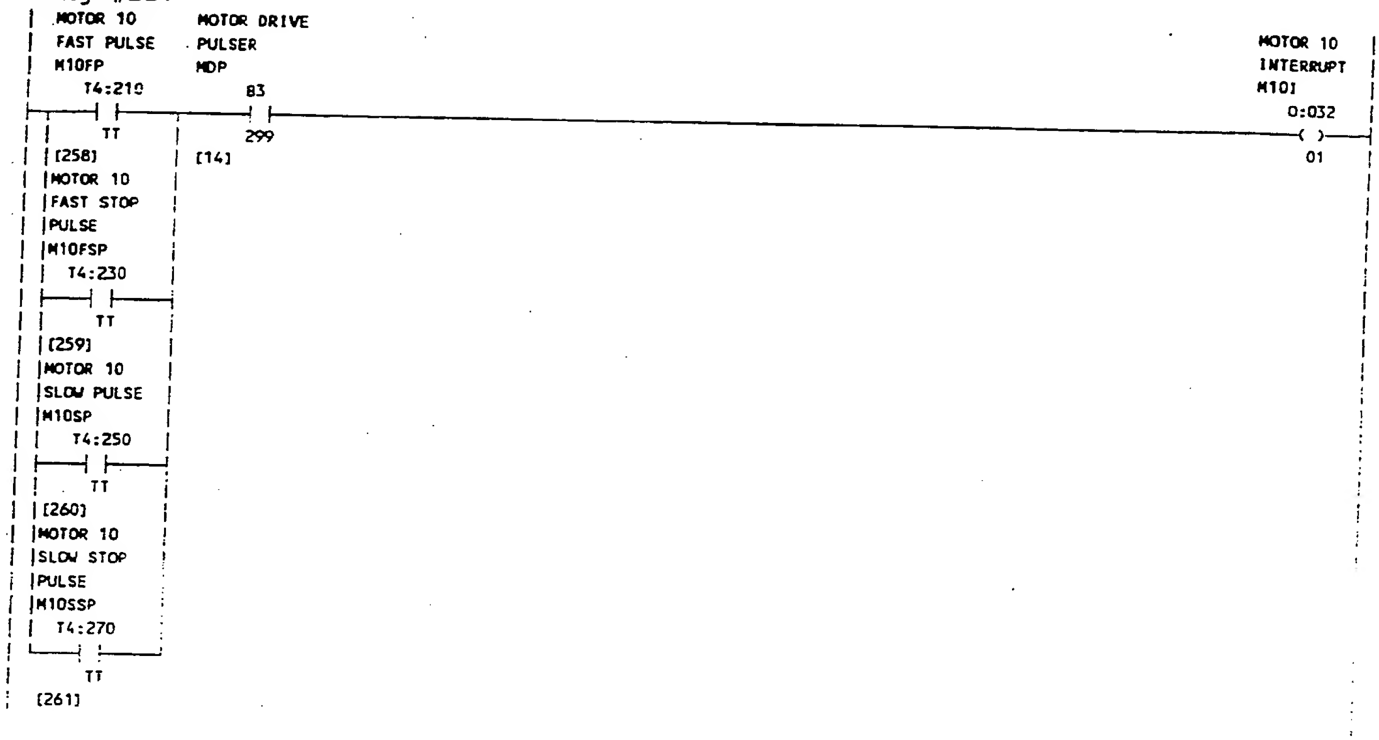
```
      AUTO     PALLET      PALLET      PAUSE                                         MOTOR 9
      MODE     DETECTED    DETECTED    PALLET IN                                     SLOW
      ENABLE   RIGHT SIDE  RIGHT SIDE  DWELL 2                                       M9S
      AUTO     CHROME      DWELL 2     MOTOR 9                                       O:033
      N7:37    SEN18       SEN21       M9PO2
               I:023       I:023       B3
      11       02          05          404                                           00
      [158]                            [628]
               PALLET
               DETECTED                O:033/00 - -| |- - File #2 MAIN_PRGRM - 249
               LEFT SIDE                          -|/|- - File #2 MAIN_PRGRM - 256
               DWELL 2                 T4:249.TT - -| |- - File #2 MAIN_PRGRM - 252
               SEN19                                                             MOTOR 9
               I:023                                                             SLOW PULSE
               03                                                                M9SP
                                                                                 TON
                                                                                 TIMER ON DELAY  (EN)
                                                                                 TIMER:  T4:249
                                                                                 BASE (SEC): 0.01 (DN)
                                                                                 PRESET:  100
                                                                                 ACCUM:   0
      MANUAL MOTOR   DOOR 5   DOOR 6
      9 ON           OPEN     OPEN
      MM9ON          DROP5S   DROP6S
      N7:23          I:026    I:026
      7              01       03
      [519]
                     PALLET
                     DETECTED
                     RIGHT SIDE
                     HEATER 3
                     SEN24
                     I:023
                     10
      MOTOR 9
      REVERSE
      M9R
      B3
      109
      [576]
```

Rung #256

```
MOTOR 9                                                                          MOTOR 9
SLOW                                                                             SLOW STOP
M9S                                                                              PULSE
O:033                                                                            M9SSP
                                                                                 TON
                                                                                 TIMER ON DELAY  (EN)
00                                                                               TIMER:  T4:269
[255]                                                                            BASE (SEC): 0.01 (DN)
                                                                                 PRESET:  100
                                                                                 ACCUM:   100

T4:269.TT - -| |- - File #2 MAIN_PRGRM - 252
```

Rung #257


MOTOR 10
FAST PULSE
M10FP
T4:210
TT
[258]
MOTOR DRIVE
PULSER
MDP
B3
299
[14]
MOTOR 10
INTERRUPT
M10I
O:032
01
MOTOR 10
FAST STOP
PULSE
M10FSP
T4:230
TT
[259]
MOTOR 10
SLOW PULSE
M10SP
T4:250
TT
[260]
MOTOR 10
SLOW STOP
PULSE
M10SSP
T4:270
TT
[261]

263

Rung #258

```
AUTO MODE ENABLE AUTO N7:37 11 [158]
DOOR 5 OPEN DROP5S I:026 01
DOOR 6 OPEN DROP6S I:026 03
PALLET DETECTED RIGHT SIDE DWELL 2 SEN21 I:023 05
PALLET DETECTED LEFT SIDE HEATER 3 SEN22 I:023 06
PALLET DETECTED RIGHT SIDE HEATER 3 SEN24 I:023 10
PALLET DETECTED RIGHT SIDE DWELL 3 SEN27 I:023 13
STOP MOTOR 10 PAUSE LATCH M10PL B3 475 [629]
MOTOR 10 REVERSE M10R B3 110 [577]
MOTOR 10 FAST M10F O:032 11
MOTOR 10 FAST PULSE M10FP
TON
TIMER ON DELAY (EN)
TIMER: T4:210
BASE (SEC): 0.01 (DN)
PRESET: 100
ACCUM: 0
MANUAL MOTOR 10 ON MM10ON N7:23 8 [520]
DOOR 5 OPEN DROP5S I:026 01
DOOR 6 OPEN DROP6S I:026 03
PALLET DETECTED RIGHT SIDE HEATER 3 SEN24 I:023 10
```

```
O:032/11 - -] [- - File #5 FAULTS - 6
           -]/[- - File #2 MAIN_PRGRM - 259
           -( )- - File #2 MAIN_PRGRM - 258
T4:210.TT - -  - - File #2 MAIN_PRGRM - 257
```

Rung #259

```
MOTOR 10 FAST M10F O:032 11 [258]
MOTOR 10 FAST STOP PULSE M10FSP
TON
TIMER ON DELAY (EN)
TIMER: T4:230
BASE (SEC): 0.01 (DN)
PRESET: 100
ACCUM: 102
```

```
T4:230.TT - - ] [ - File #2 MAIN_PRGRM - 257
```

Rung #260

MANUAL MOTOR 10 ON MM10ON N7:23 8 [520]

DOOR 5 OPEN DROP5S I:026 01

DOOR 6 OPEN DROP6S I:026 03

PALLET DETECTED RIGHT SIDE HEATER 3 SEN24 I:023 -|/|- 10

MOTOR 10 REVERSE M10R B3 110 [577]

MOTOR 10 SLOW M10S O:033 -( )- 01

O:033/01 - -|/|- - File #2 MAIN_PRGRM - 261
T4:250.TT - -| |- - File #2 MAIN_PRGRM - 257

MOTOR 10 SLOW PULSE M10SP

TON	
TIMER ON DELAY	(EN)
TIMER:	T4:250
BASE (SEC):	0.01 (DN)
PRESET:	100
ACCUM:	0

Rung #261

MOTOR 10 SLOW M10S O:033 -|/|- 01 [260]

MOTOR 10 SLOW STOP PULSE M10SSP

TON	
TIMER ON DELAY	(EN)
TIMER:	T4:270
BASE (SEC):	0.01 (DN)
PRESET:	100
ACCUM:	102

T4:270.TT - -| |- - File #2 MAIN_PRGRM - 257

Rung #262

```
MOTOR 11      MOTOR DRIVE                                    MOTOR 11
FAST PULSE    PULSER                                         INTERRUPT
M11FP         MDP                                            M11I
  T4:211        B3                                             O:032
--] [---------] [------------------------------------------------( )--
   TT          299                                               02
[263]         [14]
MOTOR 11
FAST STOP
PULSE
M11FSP
  T4:231
--] [--
   TT
[264]
MOTOR 11
SLOW PULSE
M11SP
  T4:251
--] [--
   TT
[265]
MOTOR 11
SLOW STOP
PULSE
M11SSP
  T4:271
--] [--
   TT
[266]
```

Rung #263

AUTO MODE ENABLE AUTO N7:37 11 [158]

DOOR 5 OPEN DROP5S I:026 01

DOOR 6 OPEN DROP6S I:026 03

PALLET DETECTED RIGHT SIDE HEATER 3 SEN24 I:023 10

PALLET DETECTED LEFT SIDE DWELL 3 SEN25 I:023 11

PALLET DETECTED RIGHT SIDE DWELL 3 SEN27 I:023 13 (—|/|—)

PALLET DETECTED RIGHT SIDE DWELL 3 SEN27 I:023 13

PALLET DETECTED LEFT SIDE MAGNETIC SEN28 I:037 00

PALLET DETECTED RIGHT SIDE MAGNETIC SEN30 I:037 02 (—|/|—)

PALLET DETECTED LEFT SIDE DWELL 4 SEN31 I:037 03 (—|/|—)

PALLET DETECTED RIGHT SIDE DWELL 4 SEN33 I:037 05 (—|/|—)

MANUAL MOTOR 11 ON MM11ON N7:23 9 [521]

PAUSE PALLET IN DWELL 3 MOTOR 11 M11PD3 B3 405 [628] (—|/|—)

MOTOR 11 REVERSE M11R B3 111 [578] (—|/|—)

MOTOR 11 FAST M11F O:032 —( )— 12

MOTOR 11 FAST PULSE M11FP

TON	
TIMER ON DELAY	—(EN)—
TIMER: T4:211	
BASE (SEC): 0.01	—(DN)
PRESET: 100	
ACCUM: 0	

O:032/12 - —| |— - File #2 MAIN_PRGRM - 267
File #5 FAULTS - 6
—|/|— - File #2 MAIN_PRGRM - 264
—( )— - File #2 MAIN_PRGRM - 263
T4:211.TT - —| |— - File #2 MAIN_PRGRM - 262

Rung #264

MOTOR 11 FAST M11F O:032 —|/|— 12 [263]

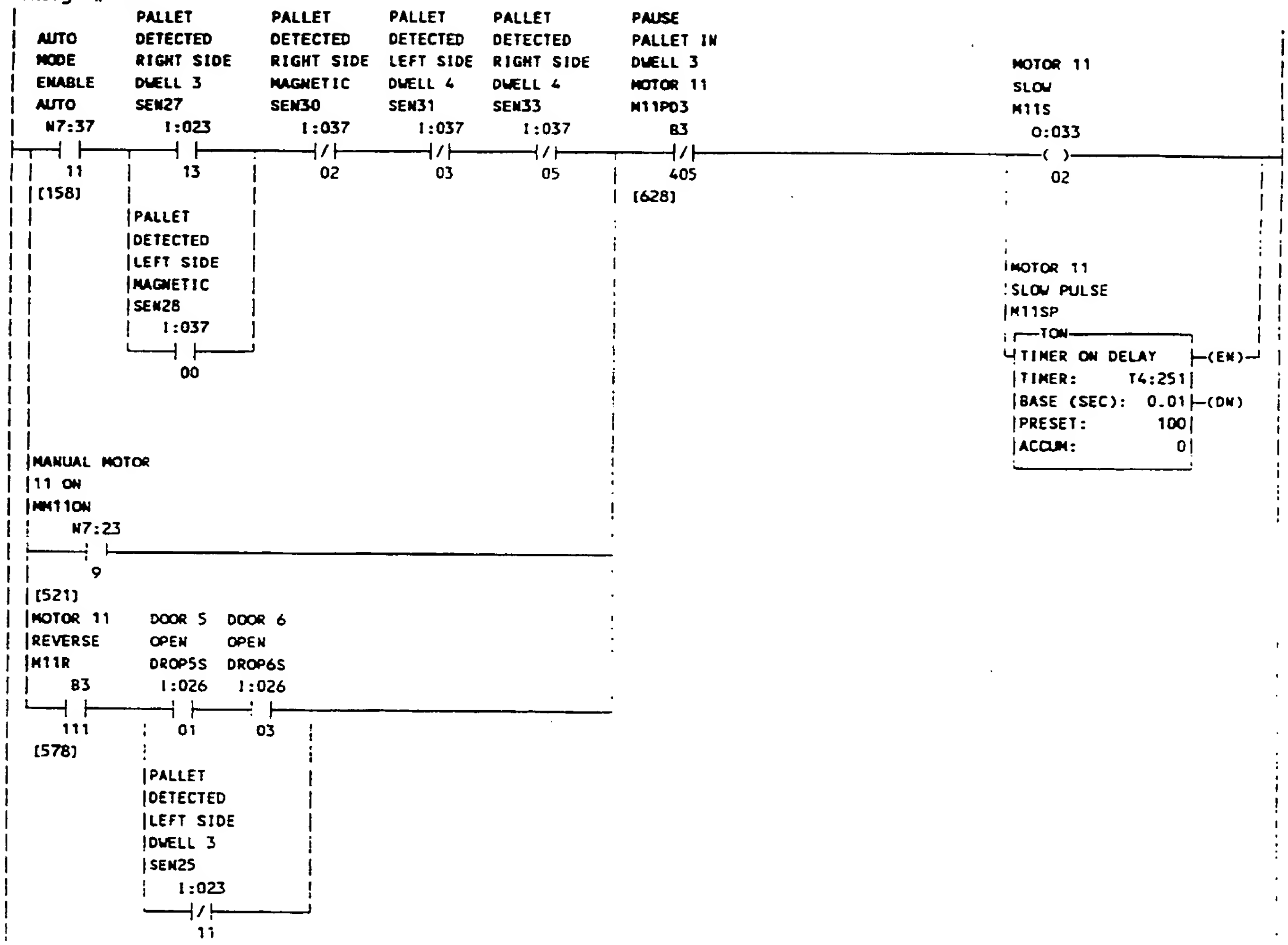
MOTOR 11 FAST STOP PULSE M11FSP

TON	
TIMER ON DELAY	—(EN)—
TIMER: T4:231	
BASE (SEC): 0.01	—(DN)
PRESET: 100	
ACCUM: 100	

T4:231.TT - —| |— - File #2 MAIN_PRGRM - 262

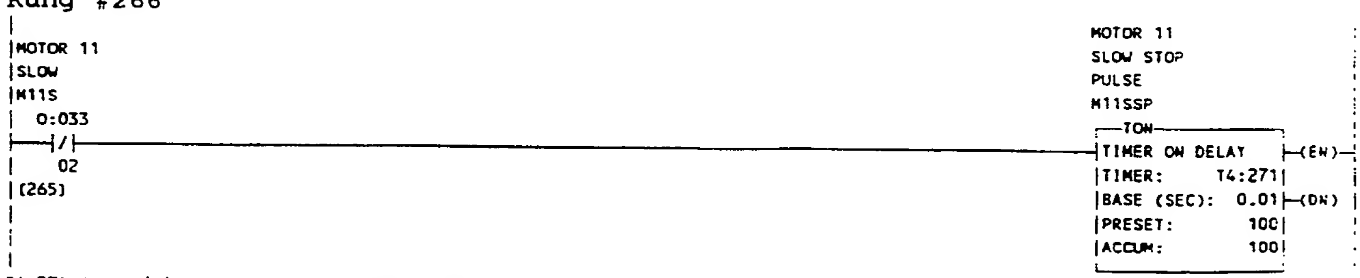
267

Rung #265



O:033/02 - -| |- - File #2 MAIN_PRGRM - 270,281
-|/|- - File #2 MAIN_PRGRM - 266
-( )- - File #2 MAIN_PRGRM - 265
T4:251.TT - -| |- - File #2 MAIN_PRGRM - 262

Rung #266



T4:271.TT - -| |- - File #2 MAIN_PRGRM - 262

```
Rung #267
|                                                                          MAGNETIC      |
|                                                                          HI POWER      |
|                  PALLET      PALLET                                      SECTIONS      |
|AUTO              DETECTED    DETECTED                                    1 AND 2       |
|MODE    MOTOR 11  RIGHT SIDE  LEFT SIDE                                   LATCHED       |
|ENABLE  FAST      DWELL 3     MAGNETIC   MAG WATER OK                     HIPRMAG1,2-LAT|
|AUTO    M11F      SEN27       SEN28      MAG_OK                                B3       |
| N7:37  0:032     I:023       I:037      B3                                             |
|--] [-----] [--------] [---------]/[--------] [------------------------------(L)--------|
|  11      12         13          00         278                               270       |
|[158]   [263]                          [726]                                            |
B3/270 - ] [ - - File #2 MAIN_PRGRM -  268
        -(L)- - File #2 MAIN_PRGRM -  267
        -(U)- - File #2 MAIN_PRGRM -  269
Rung #268
|MAGNETIC                                                                 MAGNETIC        |
|HI POWER                                                                 HI POWER        |
|SECTIONS                                                                 SUPPLY 1        |
|1 AND 2                                                                  OUTPUT          |
|LATCHED         MAG WATER OK                                             MAGPS1          |
|HIPRMAG1,2-LAT  MAG_OK                                                    0:033          |
|     B3             B3                                                                   |
|-----] [-----------] [--------------------------------------------------+----( )-------+-|
|     270            278                                                 |     14       | |
|[267]             [726]                                                 |MAGNETIC      | |
|                                                                        |HI POWER      | |
| 0:033/14 - ] [ - - File #6 TECH_RUNGS - 6                              |SUPPLY 2      | |
| B3/833 - ] [ - - File #2 MAIN_PRGRM - 620, 622                         |OUTPUT        | |
|                                                                        |MAGPS2        | |
|                                                                        |  0:033       | |
|                                                                        +----( )-------+ |
|                                                                        |     15       | |
|                                                                        |HIGH POWER    | |
|                                                                        |MAG 1 & 2     | |
|                                                                        |TO THE FIX    | |
|                                                                        |HIMAG1,2      | |
|                                                                        |     B3       | |
|                                                                        +----( )-------+ |
|                                                                             833          |
```

269

```
Rung #269
|                                                                            MAGNETIC
|          PALLET     PALLET      PALLET                                     HI POWER
| AUTO     DETECTED   DETECTED    DETECTED                                   SECTIONS
| MODE     CENTER     RIGHT SIDE  LEFT SIDE                                  1 AND 2
| ENABLE   MAGNETIC   MAGNETIC    DWELL 4                                    LATCHED
| AUTO     SEN29      SEN30       SEN31                                      HIPRMAG1,2-LAT
|  N7:37    I:037      I:037       I:037                                          B3
|-+--] [-----]/[-------] [---------] [----+-------------------------------------(U)---
| |  11        01        02          03   |                                      270
| |[158]                                  |
| |                                       | B3/270 - --] [-- - File #2 MAIN_PRGRM - 268
| |                                       |          -(L)- - File #2 MAIN_PRGRM - 267
| |MAG WATER OK                           |
| |MAG_OK                                 |
| |     B3                                |
| +-----]/[-------------------------------+
| |     278                               |
| |[726]                                  |
| |AUTO OFF                               |
| |PULSE                                  |
| |AUOFPULSE                              |
| |  T4:283                               |
| +----] [--------------------------------+
|        TT
|  [155]
Rung #270
|                                                                            TURN ON MAG
|        PALLET      PALLET                                                  HI POWER TO
|AUTO    DETECTED    DETECTED                                                SECT 3 AND 4
|MODE    RIGHT SIDE  LEFT SIDE  MOTOR 11  MOTOR 12                           TIMER DELAY
|ENABLE  DWELL 3     MAGNETIC   SLOW      FAST      MAG WATER OK             LATCH
|AUTO    SEN27       SEN28      M11S      M12F      MAG_OK                   HIPRMAG-3,4-LAT
| N7:37   I:023       I:037      O:033     O:032      B3                          B3
|--] [-----] [--------] [--------] [--------] [--------] [------------------------(L)---
|  11       13         00         02        13         278                      264
|[158]                            [265]     [281]      [726]
B3/264 - --] [-- - File #2 MAIN_PRGRM -  271
         -(L)- - File #2 MAIN_PRGRM -  270
         -(U)- - File #2 MAIN_PRGRM -  272
Rung #271
|TURN ON MAG                                                          READY TO TURN
|HI POWER TO                                                          HI POWER TO
|SECT 3 AND 4                                                         MAG SECT 3 & 4
|TIMER DELAY                                                          WHEN PALLET @
|LATCH                                                                LEFT SIDE MAG
|HIPRMAG-3,4-LAT                                                      HIPRMAG-3,4-DLY
|      B3                                                             +-TON----------------+
|-----] [-------------------------------------------------------------+TIMER ON DELAY      +-(EN)-
|      264                                                            |TIMER:       T4:301 |
|[270]                                                                |BASE (SEC):   0.01  +-(DN)
|                                                                     |PRESET:        300  |
|                                                                     |ACCUM:           0  |
|                                                                     +--------------------+
T4:301.DN - --] [-- - File #2 MAIN_PRGRM -  272,273
```

Rung #272

```
 READY TO TURN                                                TURN ON MAG
 HI POWER TO                                                  HI POWER TO
 MAG SECT 3 & 4                                               SECT 3 AND 4
 HIPRMAG-3,4-DLY                                              TIMER DELAY
      T4:301                                                  LATCH
                                                              HIPRMAG-3,4-LAT
                                                                  B3
 ----| |-------------------------------------------------------(U)----
       DN                                                        264
 [271]
                       B3/264 - -| |- - File #2 MAIN_PRGRM - 271
                                -(L)- - File #2 MAIN_PRGRM - 270
 MAG WATER OK
 MAG_OK
      B3
 ----|/|----
     278
 [726]
 AUTO OFF
 PULSE
 AUOFPULSE
   T4:283
 ----| |----
      TT
 [155]
```

Rung #273

```
 READY TO TURN                                                HI POWER TO
 HI POWER TO                                                  MAGNETIC
 MAG SECT 3 & 4                                               SECTIONS
 HIPRMAG-3,4-DLY                                              3 AND 4
      T4:301                                                  LATCHED
                                                              HIPRMAG3,4-LAT
                                                                  B3
 ----| |-------------------------------------------------------(L)----
       DN                                                        267
 [271]
B3/267 - -| |- - File #2 MAIN_PRGRM - 274
         -(L)- - File #2 MAIN_PRGRM - 273
         -(U)- - File #2 MAIN_PRGRM - 275
```

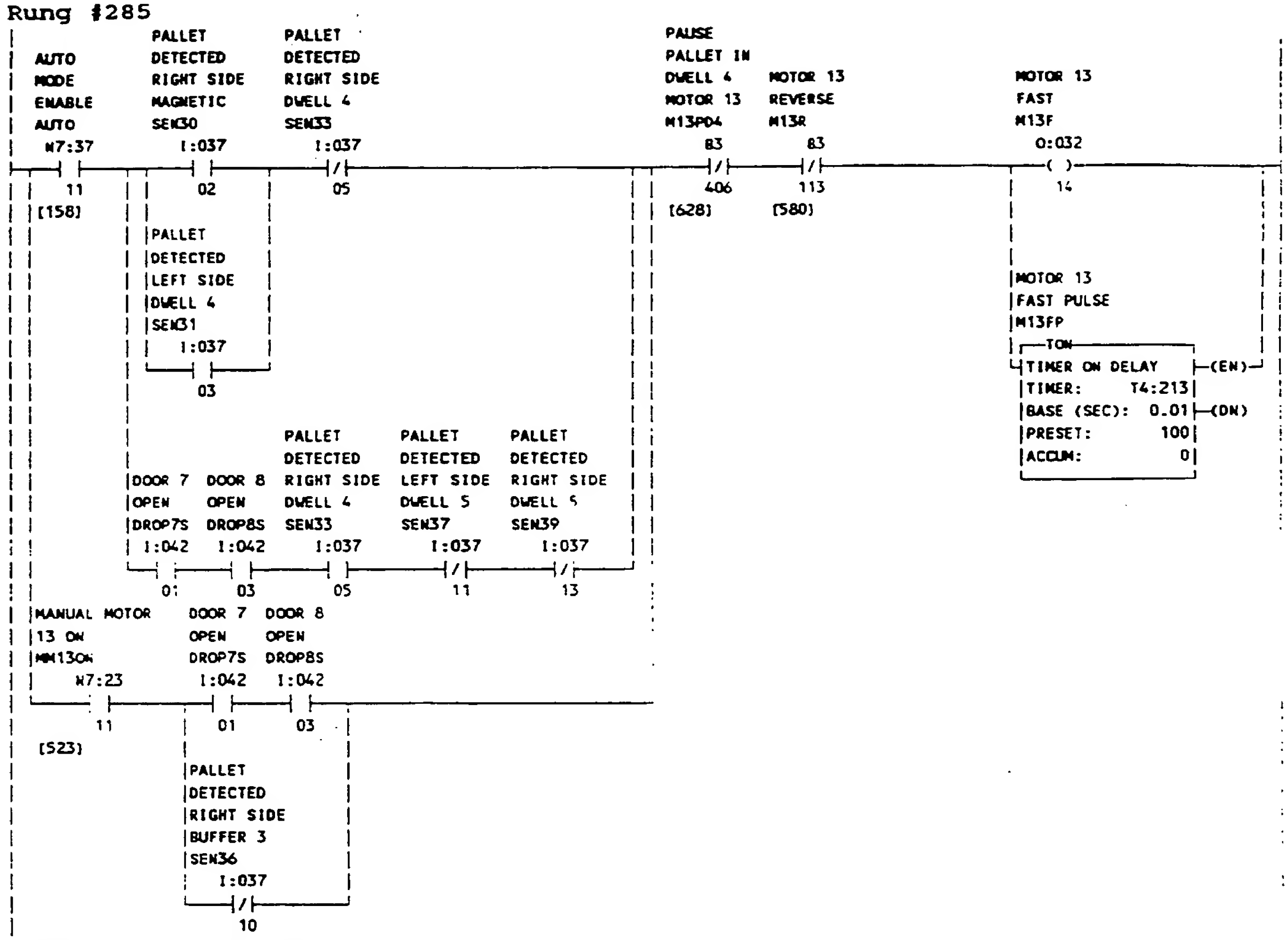
```
Rung #274
|HI POWER TO
|MAGNETIC                                                    MAGNETIC       |
|SECTIONS                                                    HI POWER       |
|3 AND 4                                                     SUPPLY 3       |
|LATCHED          MAG WATER OK                               OUTPUT         |
|HIPRMAG3,4-LAT   MAG_OK                                     MAGPS3         |
|     B3              B3                                       O:063        |
|-----| |-------------| |--------------------------------------+---( )------|
|    267             278                                       |    10      |
|[273]           [726]                                         |            |
|                                                              |MAGNETIC    |
| O:063/10 - -| |- - File #6 TECH_RUNGS - 6                    |HI POWER    |
| B3/834 - -| |- - File #2 MAIN_PRGRM - 620, 622              |SUPPLY 4    |
|                                                              |OUTPUT      |
|                                                              |MAGPS4      |
|                                                              |  O:063     |
|                                                              +---( )------|
|                                                              |    11      |
|                                                              |HIGH POWER  |
|                                                              |MAG 3 & 4   |
|                                                              |TO THE FIX  |
|                                                              |HIPRMAG3,4  |
|                                                              |    B3      |
|                                                              +---( )------|
|                                                                  834
Rung #275
|                                                            HI POWER TO
|           PALLET     PALLET                                MAGNETIC
|  AUTO     DETECTED   DETECTED                              SECTIONS
|  MODE     MIDDLE     RIGHT SIDE                            3 AND 4
|  ENABLE   DWELL 4    DWELL 4                               LATCHED
|  AUTO     SEN32      SEN33                                 HIPRMAG3,4-LAT
|   N7:37     I:037      I:037                                 B3
|-+--| |-------| |--------| |----+-----------------------------(U)----------|
| |   11        04         05    |                             267
| |[158]                         |
| |                              | B3/267 - -| |- - File #2 MAIN_PRGRM - 274
| |                              |          -(L)- - File #2 MAIN_PRGRM - 273
| |MAG WATER OK                  |
| |MAG_OK                        |
| |     B3                       |
| +----|/|-----------------------+
| |    278                       |
| |[726]                         |
| |AUTO OFF                      |
| |PULSE                         |
| |AUOFPULSE                     |
| |  T4:283                      |
| +----| |-----------------------+
|        TT
| [155]
Rung #276
|PALLET      PALLET
|DETECTED    DETECTED
|LEFT SIDE   RIGHT SIDE
|HEATER 3    HEATER 3
|SEN22       SEN24                                           MAGNETIC TIMER |
|  I:023       I:023                                         MAG_TMR        |
|                                                                 T4:72     |
|----| |---------| |------------------------------------------------(RES)----|
|    06          10                                                         |
T4:72 - RTO - File #2 MAIN_PRGRM - 278
```

```
        RES - File #2 MAIN_PRGRM -  ↓
Rung #277
|PALLET      PALLET     PALLET
|DETECTED    DETECTED   DETECTED
|LEFT SIDE   CENTER     RIGHT SIDE                                   MAGNETIC   |
|DWELL 3     DWELL 3    DWELL 3                                      TRANSIT    |
|SEN25       SEN26      SEN27                                        MAG_TRAN   |
|   I:023      I:023      I:023                                         B3      |
|----] [--------] [--------] [----------------------------------------(L)------|
|    11         12         13                                           91      |
B3/91 - ] [ - File #2 MAIN_PRGRM -  278
       -(L)- - File #2 MAIN_PRGRM -  277
       -(U)- - File #2 MAIN_PRGRM -  279
Rung #278
|MAGNETIC
|TRANSIT                                          MAGNETIC TIMER
|MAG_TRAN                                         MAG_TMR
|   B3                                            +-RTO-----------------+
|---] [-------------------------------------------|RETENTIVE TIMER ON   |-(EN)-|
|   91                                            |TIMER:        T4:72  |
|[277]                                            |BASE (SEC):     1.0  |-(DN)
|                                                 |PRESET:        1000  |
|                                                 |ACCUM:           79  |
|                                                 +---------------------+
T4:72 - RTO - File #2 MAIN_PRGRM -  278
        RES - File #2 MAIN_PRGRM -  276
Rung #279
|PALLET      PALLET     PALLET
|DETECTED    DETECTED   DETECTED
|LEFT SIDE   MIDDLE     RIGHT SIDE                                   MAGNETIC   |
|DWELL 4     DWELL 4    DWELL 4                                      TRANSIT    |
|SEN31       SEN32      SEN33                                        MAG_TRAN   |
|   I:037      I:037      I:037                                         B3      |
|----] [--------] [--------] [----------------------------------------(U)------|
|    03         04         05                                           91      |
B3/91 - ] [ - File #2 MAIN_PRGRM -  278
       -(L)- - File #2 MAIN_PRGRM -  277
       -(U)- - File #2 MAIN_PRGRM -  279
Rung #280
|  MOTOR 12        MOTOR DRIVE                                       MOTOR 12   |
|  SLOW PULSE      PULSER                                            INTERRUPT  |
|  M12SP           MDP                                               M121       |
|     T4:212         B3                                                0:032    |
|---+---] [---+------] [---------------------------------------------( )-------|
|   |    TT   |     299                                                03
|   |[281]    |   [14]
|   |MOTOR 12 |
|   |FAST STOP|
|   |PULSE    |
|   |M12FSP   |
|   | T4:232  |
|   +---] [---+
|   |    TT   |
|   |[282]    |
|   |MOTOR 12 |
|   |SLOW STOP|
|   |PULSE    |
|   |M12SSP   |
|   | T4:272  |
|   +---] [---+
|        TT
|  [283]
```

```
Rung #281
      AUTO    PALLET                      PALLET
      MODE    DETECTED                    DETECTED                  MOTOR 12  MOTOR 12
      ENABLE  RIGHT SIDE      MOTOR 11    RIGHT SIDE                REVERSE   FAST
      AUTO    DWELL 3         SLOW        DWELL 4                   M12R      M12F
              SEN27           M11S        SEN33                       B3      O:032
      N7:37   I:023           O:033       I:037
|----] [-------] [-------+------] [---+-----]/[------------------------]/[-------( )----|
      11        13       |      02    |     05                          112        13
     [158]               |    [265]   |                               [579]
        PALLET           |            |
        DETECTED         |  MOTOR 13  |                             MOTOR 12
        LEFT SIDE        |  SLOW      |                             SLOW
        MAGNETIC         |  M13S      |                             M12S
        SEN28            |   O:033    |                              O:033
         I:037           +------] [---+                          +-------( )-----------|
      +---] [---+               04                                       03
      |   00    |             [287]
        PALLET                                                      MOTOR 12
        DETECTED                                                    SLOW PULSE
        RIGHT SIDE                                                  M12SP
        MAGNETIC                                                    +--TON-----------------+
        SEN30                                                    +--|TIMER ON DELAY        |-(EN)-
         I:037                                                      |TIMER:        T4:212  |
      +---] [---+                                                   |BASE (SEC):     0.01  |-(DN)
          02                                                        |PRESET:          100  |
                                                                    |ACCUM:             0  |
   MANUAL MOTOR                                                     +----------------------+
   12 ON
   MM12ON
     N7:23
  +---] [------------------------------
      10
   [522]
   MOTOR 12
   REVERSE
   M12R
     B3
  +---] [------------------------------
     112
   [579]
O:032/13 - ] [ - - File #2 MAIN_PRGRM -  270
                   File #5 FAULTS -  7
           ]/[ - - File #2 MAIN_PRGRM -  282
           -( )- - File #2 MAIN_PRGRM -  281
O:033/03 - ]/[ - - File #2 MAIN_PRGRM -  283
           -( )- - File #2 MAIN_PRGRM -  281
T4:212.TT - ] [ - - File #2 MAIN_PRGRM -  280
Rung #282
                                                                    MOTOR 12
 MOTOR 12                                                           FAST STOP
 FAST                                                               PULSE
 M12F                                                               M12FSP
  O:032                                                             +--TON-----------------+
|---]/[-------------------------------------------------------------|TIMER ON DELAY        |-(EN)-
    13                                                              |TIMER:        T4:232  |
 [281]                                                              |BASE (SEC):     0.01  |-(DN)
                                                                    |PRESET:          100  |
                                                                    |ACCUM:           102  |
                                                                    +----------------------+
```

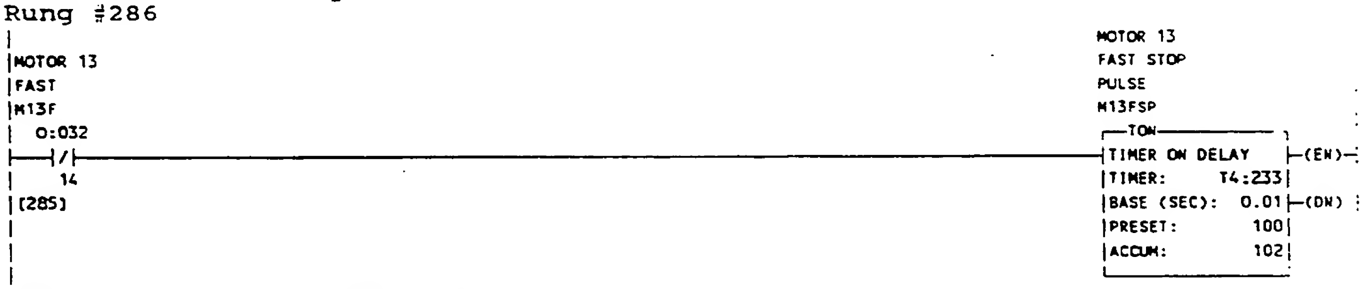
```
T4:232.TT - -| |- - File #2 MAIN_PRGRM     280
Rung #283
|                                                              MOTOR 12
|MOTOR 12                                                      SLOW STOP
|SLOW                                                          PULSE
|M12S                                                          M12SSP
| O:033                                                        +-TON----------------+
|--|/|------------------------------------------------------+-|TIMER ON DELAY      |-(EN)-
|   03                                                         |TIMER:       T4:272|
|[281]                                                         |BASE (SEC):    0.01|-(DN)
|                                                              |PRESET:         100|
|                                                              |ACCUM:          102|
|                                                              +--------------------+
T4:272.TT - -| |- - File #2 MAIN_PRGRM -  280
Rung #284
| MOTOR 13      MOTOR DRIVE                                    MOTOR 13
| FAST PULSE    PULSER                                         INTERRUPT
| M13FP         MDP                                            M13I
|    T4:213        B3                                             O:032
|-+----| |-----+----| |-------------------------------------------( )----
| |      TT    |   299                                              04
| |[285]       |  [14]
| |MOTOR 13    |
| |FAST STOP   |
| |PULSE       |
| |M13FSP      |
| |  T4:233    |
| |----| |-----|
| |      TT    |
| |[286]       |
| |MOTOR 13    |
| |SLOW PULSE  |
| |M13SP       |
| |    T4:253  |
| |----| |-----|
| |      TT    |
| |[287]       |
| |MOTOR 13    |
| |SLOW STOP   |
| |PULSE       |
| |M13SSP      |
| |  T4:273    |
| +----| |-----+
|        TT
|  [288]
```

Rung #285

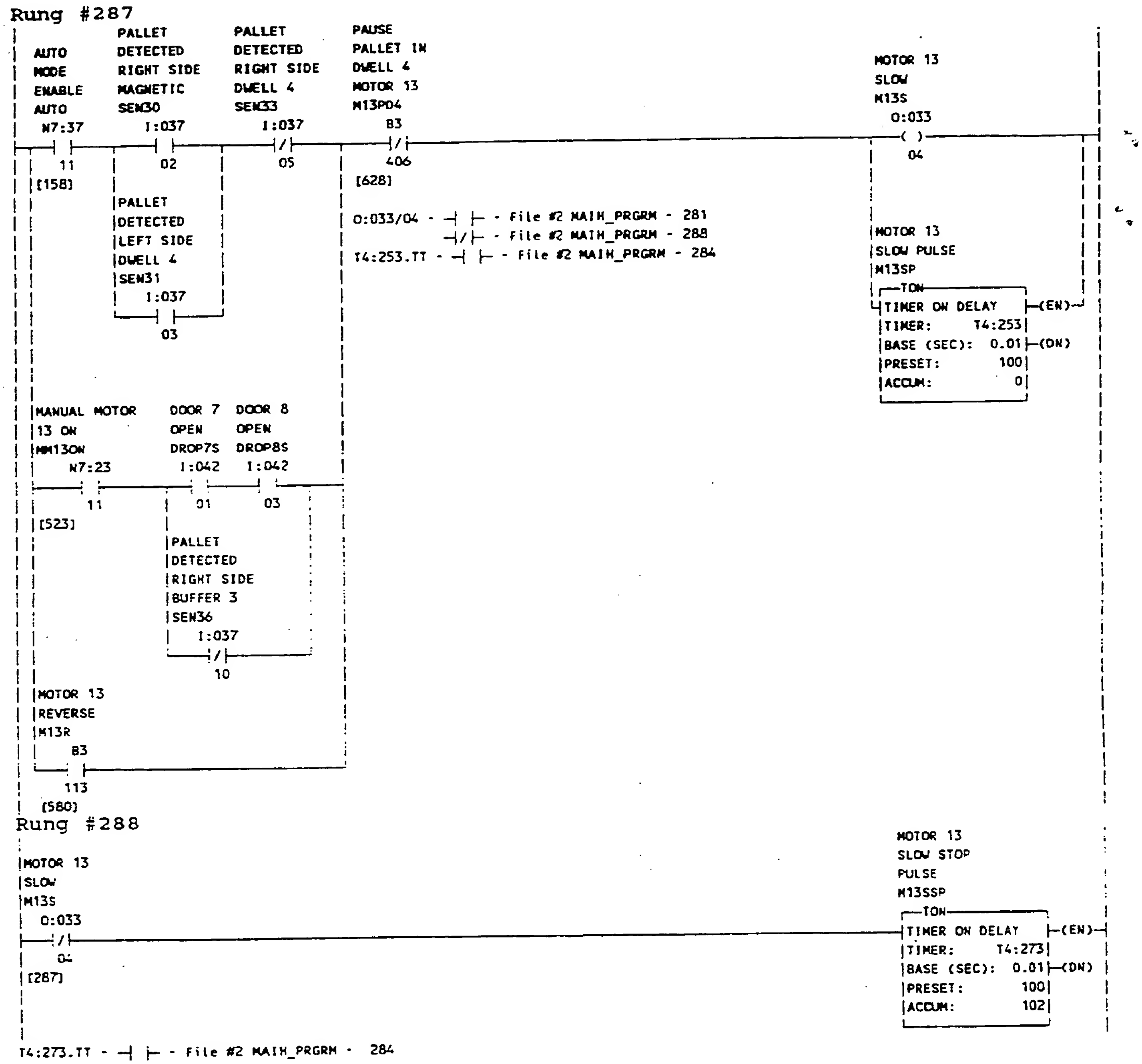


O:032/14 -] [- File #5 FAULTS - 8
]/[- File #2 MAIN_PRGRM - 286
-( )- - File #2 MAIN_PRGRM - 285
T4:213.TT -] [- File #2 MAIN_PRGRM - 284

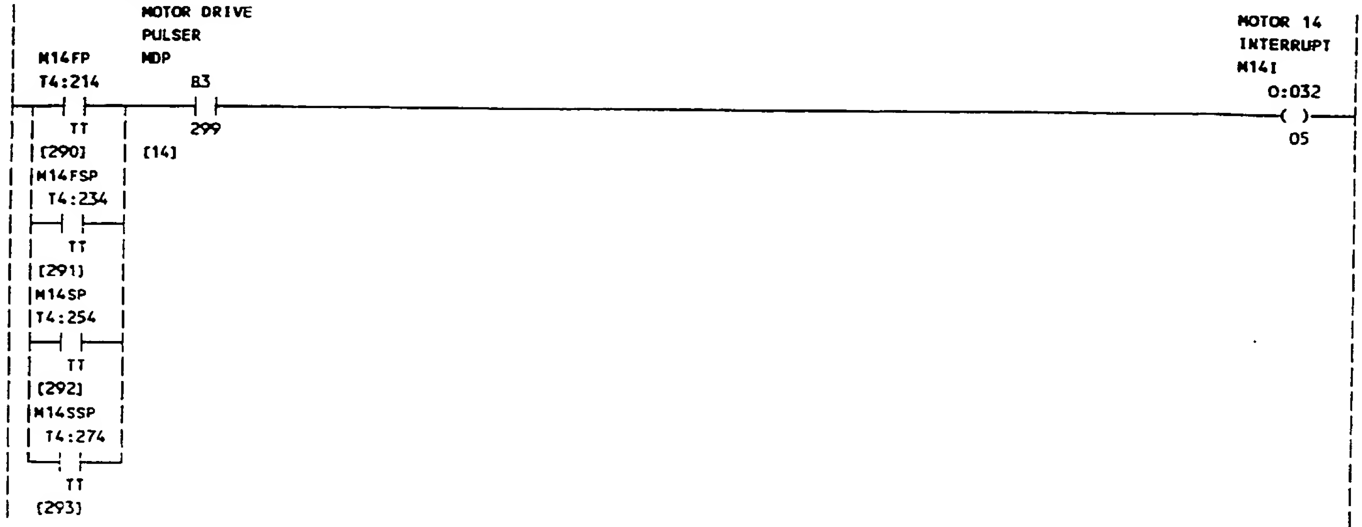
Rung #286



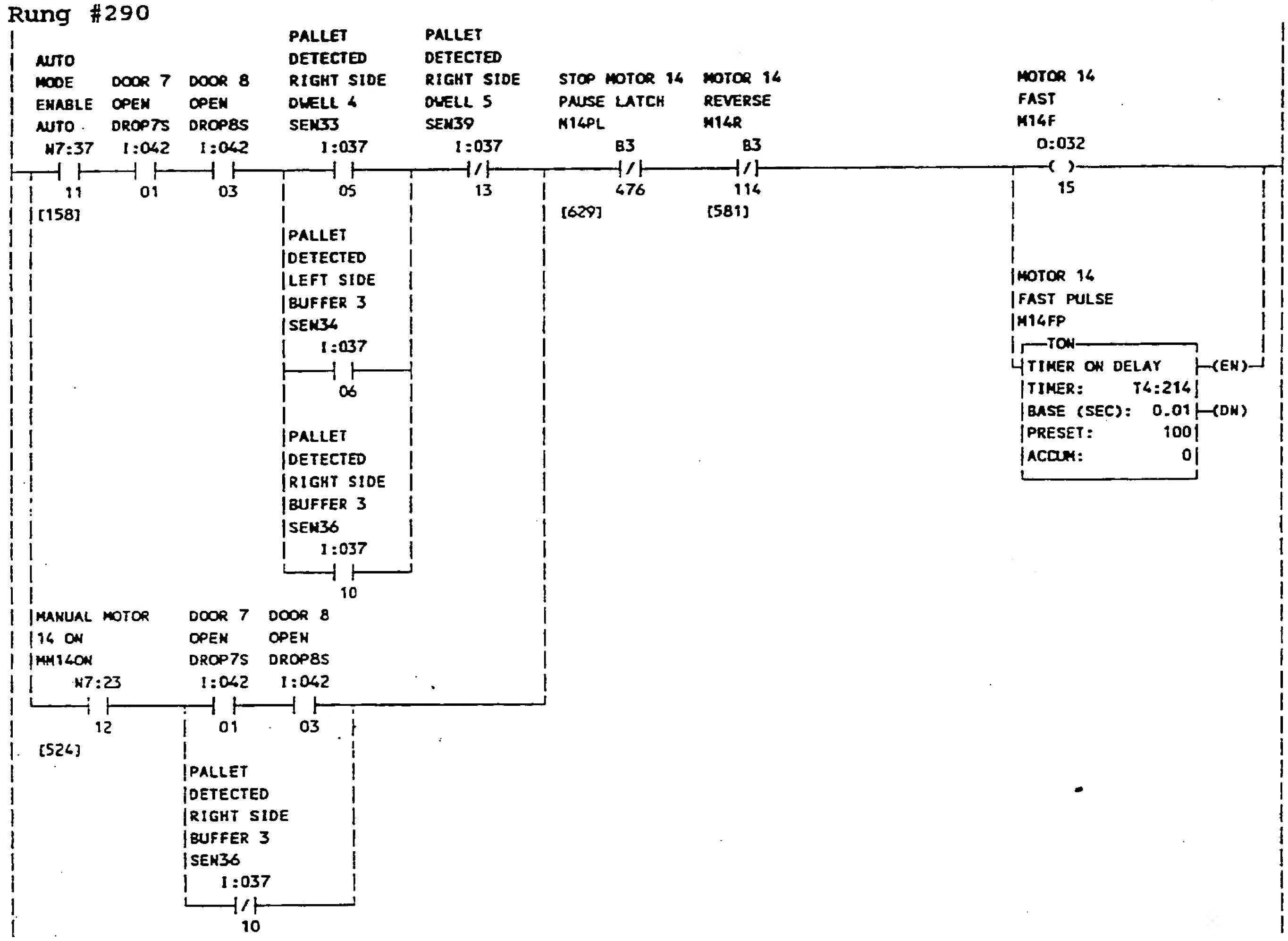
T4:233.TT -] [- File #2 MAIN_PRGRM - 284


Rung #287
AUTO MODE ENABLE AUTO
N7:37
11
[158]
PALLET DETECTED RIGHT SIDE MAGNETIC SEN30
I:037
02
PALLET DETECTED LEFT SIDE DWELL 4 SEN31
I:037
03
PALLET DETECTED RIGHT SIDE DWELL 4 SEN33
I:037
05
PAUSE PALLET IN DWELL 4 MOTOR 13 M13P04
B3
406
[628]
O:033/04 - ┤ ├ - File #2 MAIN_PRGRM - 281
┤/├ - File #2 MAIN_PRGRM - 288
T4:253.TT - ┤ ├ - File #2 MAIN_PRGRM - 284
MOTOR 13 SLOW M13S
O:033
04
MOTOR 13 SLOW PULSE M13SP
TON
TIMER ON DELAY
(EN)
TIMER: T4:253
BASE (SEC): 0.01
(DN)
PRESET: 100
ACCUM: 0
MANUAL MOTOR 13 ON MM13ON
N7:23
11
[523]
DOOR 7 OPEN DROP7S
I:042
01
DOOR 8 OPEN DROP8S
I:042
03
PALLET DETECTED RIGHT SIDE BUFFER 3 SEN36
I:037
10
MOTOR 13 REVERSE M13R
B3
113
[580]
Rung #288
MOTOR 13 SLOW M13S
O:033
04
[287]
MOTOR 13 SLOW STOP PULSE M13SSP
TON
TIMER ON DELAY
(EN)
TIMER: T4:273
BASE (SEC): 0.01
(DN)
PRESET: 100
ACCUM: 102
T4:273.TT - ┤ ├ - File #2 MAIN_PRGRM - 284

Rung #289

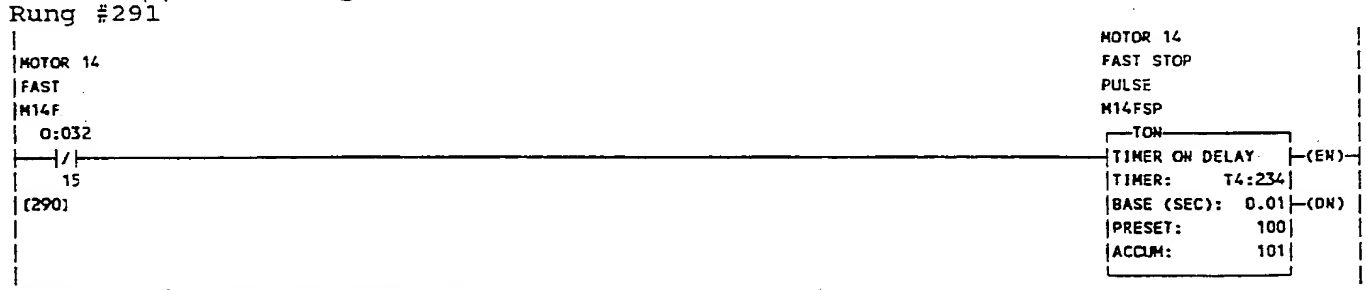

MOTOR DRIVE
PULSER
MDP
B3
299
[14]
M14FP
T4:214
TT
[290]
M14FSP
T4:234
TT
[291]
M14SP
T4:254
TT
[292]
M14SSP
T4:274
TT
[293]
MOTOR 14
INTERRUPT
M14I
O:032
05

Rung #290



O:032/15 - ⊣ ⊢ - File #5 FAULTS - 9
⊣/⊢ - File #2 MAIN_PRGRM - 291
-( )- - File #2 MAIN_PRGRM - 290
T4:214.TT - ⊣ ⊢ - File #2 MAIN_PRGRM - 289

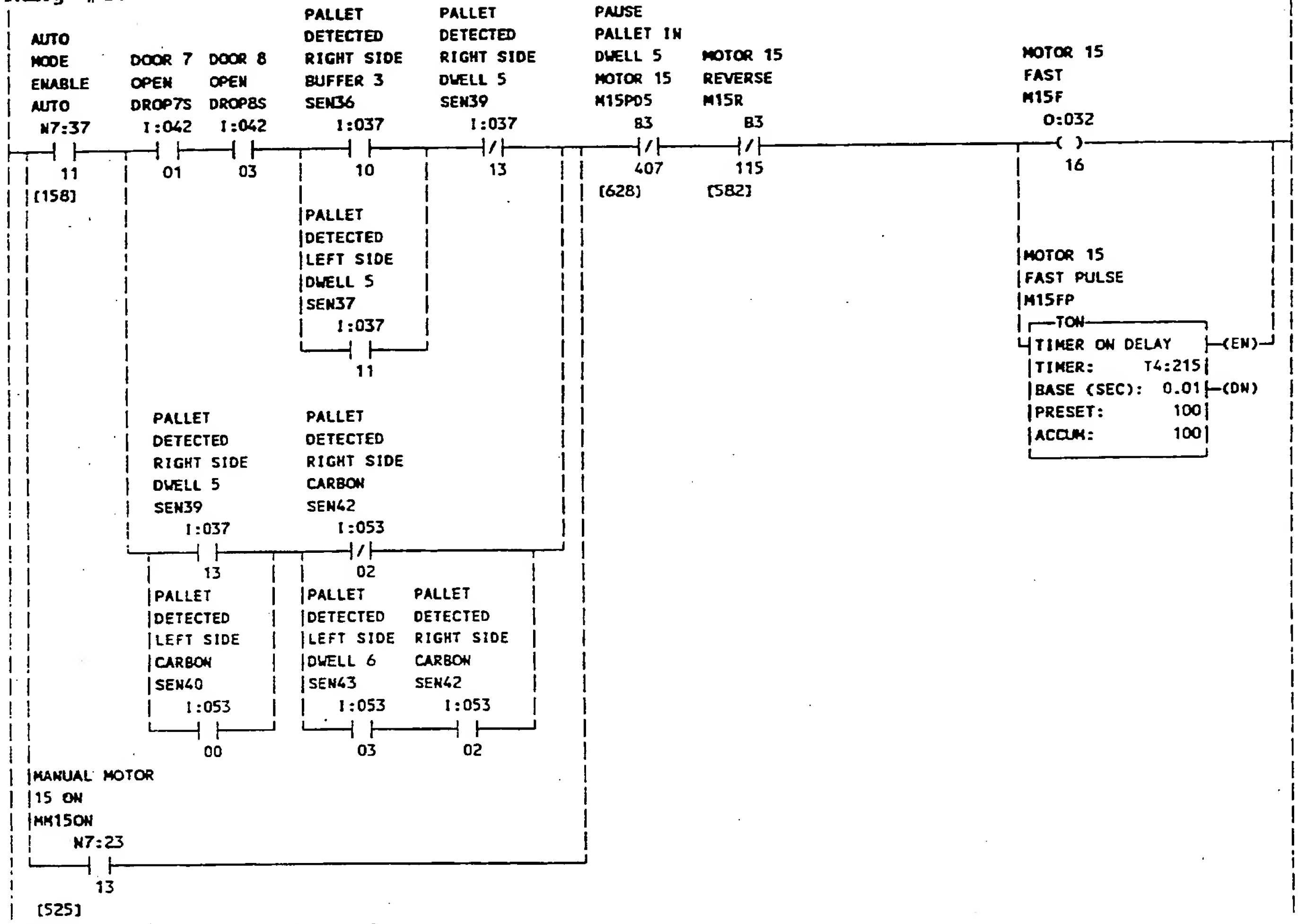
Rung #291



T4:234.TT - ⊣ ⊢ - File #2 MAIN_PRGRM - 289

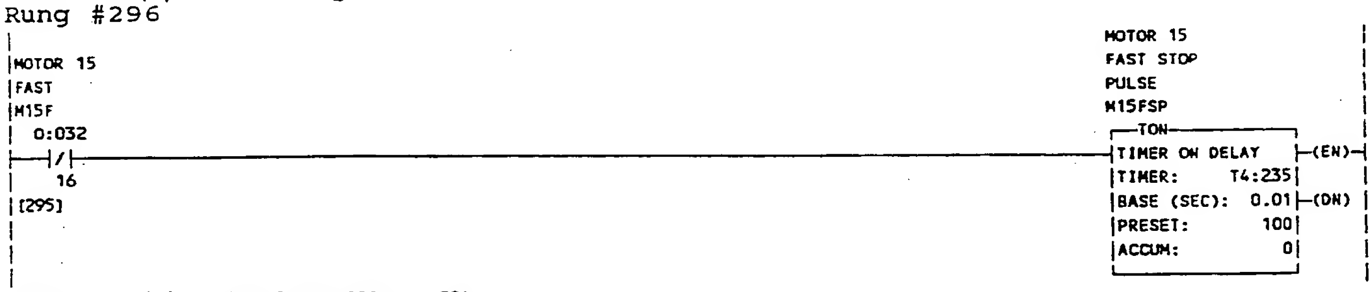
```
Rung #292
| MANUAL MOTOR      DOOR 7   DOOR 8                                   MOTOR 14
| 14 ON             OPEN     OPEN                                     SLOW
| MM14ON            DROP7S   DROP8S                                   M14S
|     N7:23          I:042    I:042                                    O:033
|-+---] [---------+---] [-----] [---+-+-------------------------------+---( )---+-|
| |    12         |    01       03  | |                               |    05    | |
| |[524]          |                 | |                               |          | |
| |               |PALLET           | | O:033/05 - ]/[ - File #2 MAIN_PRGRM - 293 | |
| |               |DETECTED         | | T4:254.TT - ] [ - File #2 MAIN_PRGRM - 289| |
| |               |RIGHT SIDE       | |                               |MOTOR 14  | |
| |               |BUFFER 3         | |                               |SLOW PULSE| |
| |               |SEN36            | |                               |M14SP     | |
| |               |    I:037        | |                               |+-TON-----------+ |
| |               +----]/[----------+ |                               +|TIMER ON DELAY |-(EN)-+
| |                     10            |                                |TIMER:  T4:254 |
| |                                   |                                |BASE (SEC): 0.01|-(DN)
| |                                   |                                |PRESET:    100 |
| |MOTOR 14                           |                                |ACCUM:       0 |
| |REVERSE                            |                                +---------------+
| |M14R                               |
| |     B3                            |
| +----] [----------------------------+
|      114
| [581]
Rung #293
|                                                                     MOTOR 14
|MOTOR 14                                                             SLOW STOP
|SLOW                                                                 PULSE
|M14S                                                                 M14SSP
| O:033                                                               +-TON-----------+
|---]/[---------------------------------------------------------------|TIMER ON DELAY |-(EN)-|
|    05                                                               |TIMER:  T4:274 |
|[292]                                                                |BASE (SEC): 0.01|-(DN)
|                                                                     |PRESET:    100 |
|                                                                     |ACCUM:     102 |
|                                                                     +---------------+
T4:274.TT - ] [ - File #2 MAIN_PRGRM - 289
Rung #294
|            MOTOR DRIVE                                                  MOTOR 15
|            PULSER                                                       INTERRUPT
|  M15FP     MDP                                                          M151
|  T4:215     B3                                                           O:032
|-+---] [---+---] [--------------------------------------------------------( )---|
| |   TT    |   299                                                        06
| |[295]    | [14]
| |M15FSP   |
| | T4:235  |
| +---] [---+
| |   TT    |
| |[296]    |
| |M15SP    |
| |T4:255   |
| +---] [---+
| |   TT    |
| |[297]    |
| |M15SSP   |
| | T4:275  |
| +---] [---+
|     TT
|  [298]
```

Rung #295



O:032/16 - ‑| |‑ - File #5 FAULTS - 9
‑|/|‑ - File #2 MAIN_PRGRM - 296
‑( )‑ - File #2 MAIN_PRGRM - 295
T4:215.TT - ‑| |‑ - File #2 MAIN_PRGRM - 294

Rung #296



T4:235.TT - ‑| |‑ - File #2 MAIN_PRGRM - 294

Rung #297

```
|          PALLET          PALLET                  PAUSE
| AUTO     DETECTED        DETECTED                PALLET IN
| MODE     RIGHT SIDE      RIGHT SIDE              DWELL 5                              MOTOR 15
| ENABLE   DWELL 5         CARBON                  MOTOR 15                             SLOW
| AUTO     SEN39           SEN42                   M15P05                               M15S
|  N7:37     I:037           I:053                  B3                                  O:033
|--] [---+---] [---+---+---]/[---------+-+---------]/[------------------------------+------( )------|
|   11   |    13   |   |    02          |   407                                     |      06
| [158]  |         |   |                |  [628]                                    |
|        |PALLET   |   |PALLET  PALLET  |                                           |
|        |DETECTED |   |DETECTED DETECTED                                           |MOTOR 15
|        |LEFT SIDE|   |LEFT SIDE RIGHT SIDE                                        |SLOW PULSE
|        |CARBON   |   |DWELL 6  CARBON |                                           |M15SP
|        |SEN40    |   |SEN43    SEN42  |                                           +-TON--------------------+
|        |  I:053  |   |  I:053   I:053 |                                           +-|TIMER ON DELAY     |-(EN)-+
|        +---] [---+   +---] [-----] [--+                                             |TIMER:      T4:255|
|             00            03      02  |                                             |BASE (SEC):   0.01|-(DN)
|                                       |                                             |PRESET:        100|
|                                       |                                             |ACCUM:         100|
|MANUAL MOTOR                           |
|15 ON                                  |
|MM15ON                                 |
|   N7:23                               |
|----] [--------------------------------+
|     13                                |
|[525]                                  |
|MOTOR 15    DOOR 7   DOOR 8            |
|REVERSE     OPEN     OPEN              |
|M15R        DROP7S   DROP8S            |
|   B3        I:042    I:042            |
+---] [---+---] [------] [---+----------+
    115   |    01        03  |
 [582]    |                  |
          |PALLET            |
          |DETECTED          |
          |LEFT SIDE         |
          |DWELL 5           |
          |SEN37             |
          |   I:037          |
          +----]/[-----------+
                11
O:033/06 - -] [- - File #2 MAIN_PRGRM -  299,300,306
           -]/[- - File #2 MAIN_PRGRM -  298
           -( )- - File #2 MAIN_PRGRM -  297
T4:255.TT - -] [- - File #2 MAIN_PRGRM -  294
```

Rung #298

```
|                                                                  MOTOR 15
|MOTOR 15                                                          SLOW STOP
|SLOW                                                              PULSE
|M15S                                                              M15SSP
| O:033                                                            +-TON--------------+
|--]/[-------------------------------------------------------------|TIMER ON DELAY    |-(EN)-|
|   06                                                             |TIMER:      T4:275|
|[297]                                                             |BASE (SEC):   0.01|-(DN)
|                                                                  |PRESET:        100|
|                                                                  |ACCUM:           0|
T4:275.TT - -] [- - File #2 MAIN_PRGRM -  294
```

```
Rung #299
|                                   PALLET                                                          CARBON
|AUTO                               DETECTED                                                        HI POWER
|MODE                               RIGHT SIDE   MOTOR 15                                           SUPPLY 1
|ENABLE   CARBON WATER OK           DWELL 5      SLOW                                               OUTPUT
|AUTO     CAR_OK                    SEN39        M15S                                               CARPS1
| N7:37        B3                     I:037        O:033                                             O:063
|--] [---------] [---------------+----] [----+----] [----+------------------------------------+--------( )----+--
|   11        279                |     13    |     06    |                                    |         12     |
|[158]    [727]                  |           |   [297]   |                                    |                |
|                                | |PALLET   |           | O:063/12 - ] [ - File #6 TECH_RUNGS - 6  |CARBON   |
|                                | |DETECTED |           | B3/835 - ] [ - File #2 MAIN_PRGRM - 620, 622 |HI POWER |
|                                | |LEFT SIDE|           |                                    |SUPPLY 2        |
|                                | |CARBON   |           |                                    |OUTPUT          |
|                                | |SEN40    |           |                                    |CARPS2          |
|                                | |  I:053  |           |                                    |  O:063         |
|                                | +---] [---+           |                                    +---( )----------+
|                                |      00               |                                    |    13          |
|                                |PALLET                 |                                    |                |
|                                |DETECTED               |                                    |HIGH POWER      |
|                                |CENTER                 |                                    |CARBON 1 & 2    |
|                                |CARBON                 |                                    |TO THE FIX      |
|                                |SEN41                  |                                    |HIPRCAR1,2      |
|                                |  I:053                |                                    |      B3        |
|                                +---] [-----------------+                                    +------( )-------+
|                                     01                                                            835
Rung #300
|                                 PALLET                                                            CARBON
|AUTO                             DETECTED                                                          HI POWER
|MODE                             LEFT SIDE  MOTOR 15                                               SUPPLY 3
|ENABLE   CARBON WATER OK         CARBON     SLOW                                                   OUTPUT
|AUTO     CAR_OK                  SEN40      M15S                                                   CARPS3
| N7:37        B3                   I:053      O:033                                                 O:063
|--] [---------] [-------------+----] [------] [----+-----------------------------------------+--------( )----+--
|   11        279              |     00        06   |                                         |        14      |
|[158]    [727]                |             [297]  |                                         |                |
|                              |                    | O:063/14 - ] [ - File #6 TECH_RUNGS - 6 |CARBON          |
|                              |                    | B3/836 - ] [ - File #2 MAIN_PRGRM - 620, 622 |HI POWER   |
|                              |PALLET              |                                         |SUPPLY 4        |
|                              |DETECTED            |                                         |OUTPUT          |
|                              |CENTER              |                                         |CARPS4          |
|                              |CARBON              |                                         |  O:063         |
|                              |SEN41               |                                         +---( )----------+
|                              |  I:053             |                                         |   15           |
|                              +---] [--------------+                                         |                |
|                              |   01               |                                         |HIGH POWER      |
|                              |PALLET              |                                         |CARBON 3 & 4    |
|                              |DETECTED            |                                         |TO THE FIX      |
|                              |RIGHT SIDE          |                                         |HIPRCAR3,4      |
|                              |CARBON              |                                         |      B3        |
|                              |SEN42               |                                         +------( )-------+
|                              |  I:053             |                                              836
|                              +---] [--------------+
|                                   02
Rung #301
|PALLET      PALLET
|DETECTED    DETECTED
|LEFT SIDE   RIGHT SIDE
|BUFFER 3    BUFFER 3                                                                     CARBON TIMER
|SEN34       SEN36                                                                        CAR_TMR
|  I:037       I:037                                                                          T4:73
|---] [--------] [------------------------------------------------------------------------------(RES)----
>                                                                                                        >
```

```
<                                                                              <
|    06        10                                                              |
T4:73 - RTO - File #2 MAIN_PRGRM -  303
        RES - File #2 MAIN_PRGRM -  301
Rung #302
|PALLET     PALLET    PALLET                                                   |
|DETECTED   DETECTED  DETECTED                                                 |
|LEFT SIDE  CENTER    RIGHT SIDE                                               |
|DWELL 5    DWELL 5   DWELL 5                                 CARBON TRANSIT   |
|SEN37      SEN38     SEN39                                   CAR_TRAN         |
|  I:037     I:037     I:037                                        B3         |
|----] [-------] [-------] [-------------------------------------------(L)-----|
|    11        12        13                                           92       |
B3/92 - ] [ - File #2 MAIN_PRGRM -  303
      -(L)- - File #2 MAIN_PRGRM -  302
      -(U)- - File #2 MAIN_PRGRM -  304
Rung #303
|CARBON TRANSIT                                          CARBON TIMER          |
|CAR_TRAN                                                CAR_TMR               |
|       B3                                               +-RTO--------------+  |
|------] [-----------------------------------------------+RETENTIVE TIMER ON+-(EN)-|
|       92                                               |TIMER:       T4:73|  |
|[302]                                                   |BASE (SEC):    1.0+-(DN)|
|                                                        |PRESET:       1000|  |
|                                                        |ACCUM:           6|  |
|                                                        +------------------+  |
T4:73 - RTO - File #2 MAIN_PRGRM -  303
        RES - File #2 MAIN_PRGRM -  301
Rung #304
|PALLET     PALLET    PALLET                                                   |
|DETECTED   DETECTED  DETECTED                                                 |
|LEFT SIDE  CENTER    RIGHT SIDE                                               |
|DWELL 6    DWELL 6   DWELL 6                                 CARBON TRANSIT   |
|SEN43      SEN44     SEN45                                   CAR_TRAN         |
|  I:053     I:053     I:053                                        B3         |
|----] [-------] [-------] [-------------------------------------------(U)-----|
|    03        04        05                                           92       |
B3/92 - ] [ - File #2 MAIN_PRGRM -  303
      -(L)- - File #2 MAIN_PRGRM -  302
      -(U)- - File #2 MAIN_PRGRM -  304
Rung #305
|           MOTOR DRIVE                                        MOTOR 16        |
|           PULSER                                             INTERRUPT       |
|  M16SP    MDP                                                M16I            |
|  T4:216      B3                                               O:032          |
|-+--] [--+----] [-----------------------------------------------( )-----------|
| |   TT  |    299                                               07            |
| |[306]  | [14]                                                               |
| |M16FSP |                                                                    |
| | T4:236|                                                                    |
| |--] [--|                                                                    |
| |   TT  |                                                                    |
| |[307]  |                                                                    |
| |M16SSP |                                                                    |
| | T4:276|                                                                    |
| +--] [--+                                                                    |
|     TT                                                                       |
|  [308]                                                                       |
```

284

Rung #306

```
   AUTO      PALLET                                          MOTOR 16   MOTOR 16
   MODE      DETECTED      MOTOR 15                          REVERSE    FAST
   ENABLE    RIGHT SIDE    SLOW                              M16R       M16F
   AUTO      DWELL 5       M15S                                B3       0:032
   N7:37     SEN39         0:033                             --|/|------( )--
   --| |------| |-----------| |----                            116        17
     11        13             06                             [583]
   [158]                   [297]
             PALLET                  0:032/17 - -| |- - File #5 FAULTS - 10
             DETECTED                           -|/|- - File #2 MAIN_PRGRM - 307
             LEFT SIDE               0:033/07 - -|/|- - File #2 MAIN_PRGRM - 308
             CARBON                  T4:216.TT - -| |- - File #2 MAIN_PRGRM - 305
             SEN40         MOTOR 17                          MOTOR 16
             I:053         SLOW                              SLOW
             --| |--       M17S                              M16S
               00          0:063                              0:033
                           --| |--                           ---( )---
                              00                                07
             PALLET        [312]
             DETECTED
             CENTER
             CARBON                                          MOTOR 16
             SEN41                                           SLOW PULSE
             I:053                                           M16SP
             --| |--                                         +-TON--------------------+
               01                                            |TIMER ON DELAY          |-(EN)-
                                                             |TIMER:           T4:216 |
             PALLET                                          |BASE (SEC):        0.01 |-(DN)
             DETECTED                                        |PRESET:             100 |
             RIGHT SIDE                                      |ACCUM:              100 |
             CARBON                                          +------------------------+
             SEN42
             I:053
             --| |--
               02
   MANUAL MOTOR
   16 ON
   MM16ON
     N7:23
   --| |--
     14
   [526]
   MOTOR 16
   REVERSE
   M16R
     B3
   --| |--
     116
   [583]
```

Rung #307

```
                                                             MOTOR 16
 MOTOR 16                                                    FAST STOP
 FAST                                                        PULSE
 M16F                                                        M16FSP
 0:032                                                       +-TON--------------------+
 --|/|-------------------------------------------------------|TIMER ON DELAY          |-(EN)-
    17                                                       |TIMER:           T4:236 |
 [306]                                                       |BASE (SEC):        0.01 |-(DN)
                                                             |PRESET:             100 |
                                                             |ACCUM:                0 |
                                                             +------------------------+
```

```
T4:236.TT - -| |- - File #2 MAIN_PRGR.     305
Rung #308
|                                                              MOTOR 16          |
|MOTOR 16                                                      SLOW STOP         |
|SLOW                                                          PULSE             |
|M16S                                                          M16SSP            |
|  O:033                                                       +-TON-----------+ |
|--]/[-------------------------------------------------------- |TIMER ON DELAY |-(EN)-|
|   07                                                         |TIMER:   T4:276| |
|[306]                                                         |BASE (SEC): 0.01|-(DN) |
|                                                              |PRESET:     100| |
|                                                              |ACCUM:        0| |
|                                                              +---------------+ |
T4:276.TT - -| |- - File #2 MAIN_PRGRM -  305
Rung #309
|            MOTOR DRIVE                                       MOTOR 17   |
|            PULSER                                            INTERRUPT  |
|  M17FP     MDP                                               M17I       |
|  T4:217         B3                                             O:062    |
|-+-] [----+------] [------------------------------------------------( )---|
| |  TT    |      299                                              00     |
| |[310]   |  [14]                                                        |
| |M17FSP  |                                                              |
| | T4:237 |                                                              |
| |-] [----|                                                              |
| |  TT    |                                                              |
| |[311]   |                                                              |
| |M17SP   |                                                              |
| |T4:257  |                                                              |
| |-] [----|                                                              |
| |  TT    |                                                              |
| |[312]   |                                                              |
| |M17SSP  |                                                              |
| | T4:277 |                                                              |
| +-] [----+                                                              |
|    TT                                                                   |
|  [313]                                                                  |
```

Rung #310

```
|          PALLET      PALLET                              PAUSE
| AUTO     DETECTED    DETECTED                            PALLET IN
| MODE     RIGHT SIDE  RIGHT SIDE                          DWELL 6     MOTOR 17        MOTOR 17
| ENABLE   CARBON      DWELL 6                             MOTOR 17    REVERSE         FAST
| AUTO     SEN42       SEN45                               M17PD6      M17R            M17F
|  N7:37      I:053       I:053                              B3          B3             O:062
|--] [--------] [--------]/[------------------------------+--]/[-------]/[------------+--( )--+--|
| |  11   | |  02    |    05                              | |  408       117         |   10   |  |
| |[158]  | |        |                                  | |[628]      [584]        |        |  |
| |       | |PALLET  |                                  | |                        |        |  |
| |       | |DETECTED|                                  | |                        |MOTOR 17|  |
| |       | |LEFT SIDE                                  | |                        |FAST PULSE |
| |       | |DWELL 6 |                                  | |                        |M17FP   |  |
| |       | |SEN43   |                                  | |                        | +-TON-------------+  |
| |       | |  I:053 |                                  | |                        +-|TIMER ON DELAY   |-(EN)-+
| |       | +---] [--+                                  | |                          |TIMER:    T4:217 |     |
| |       |      03                                     | |                          |BASE (SEC): 0.01 |-(DN)|
| |       |                                             | |                          |PRESET:     100  |     |
| |       |                  PALLET     PALLET     PALLET | |                        |ACCUM:        0  |     |
| |       |                  DETECTED   DETECTED   DETECTED                          +-----------------+     |
| |       |DOOR 9   DOOR 10  RIGHT SIDE LEFT SIDE  RIGHT SIDE                                            |
| |       |OPEN     OPEN     DWELL 6    EXBUFFER   EXBUFFER | |                                           |
| |       |DROP9S   DROP10S  SEN45      SEN49      SEN51    | |                                           |
| |       | I:056    I:056     I:053      I:053      I:053  | |                                           |
| |       +--] [------] [------] [--------]/[--------]/[----+ |                                           |
| |          01       03        05         11         13      |                                           |
| |MANUAL MOTOR     DOOR 9   DOOR 10                          |                                           |
| |17 ON            OPEN     OPEN                             |                                           |
| |MM17ON           DROP9S   DROP10S                          |                                           |
| |   N7:23          I:056    I:056                           |                                           |
| +----] [------------] [------] [---------------------------+                                           |
|      15          |   01       03 |                                                                     |
| [527]            |              |                                                                     |
|                  |PALLET        |                                                                     |
|                  |DETECTED      |                                                                     |
|                  |RIGHT SIDE    |                                                                     |
|                  |BUFFER 4      |                                                                     |
|                  |SEN48         |                                                                     |
|                  |   I:053      |                                                                     |
|                  +----]/[-------+                                                                     |
|                        10                                                                              |
O:062/10 - ] [ - File #5 FAULTS -    11
           ]/[ - File #2 MAIN_PRGRM - 311
           ( ) - File #2 MAIN_PRGRM - 310
T4:217.TT - ] [ - File #2 MAIN_PRGRM - 309
```

Rung #311

```
|                                                                   MOTOR 17
|MOTOR 17                                                           FAST STOP
|FAST                                                               PULSE
|M17F                                                               M17FSP
|  O:062                                                            +-TON-------------+
|---]/[-------------------------------------------------------------|TIMER ON DELAY   |-(EN)-|
|    10                                                             |TIMER:    T4:237 |      |
|[310]                                                              |BASE (SEC): 0.01 |-(DN) |
|                                                                   |PRESET:     100  |      |
|                                                                   |ACCUM:      102  |      |
|                                                                   +-----------------+      |
T4:237.TT - ] [ - File #2 MAIN_PRGRM - 309
```

Rung #321

```
|                                                                    MOTOR 19
|MOTOR 19                                                            FAST STOP
|FAST                                                                PULSE
|M19F                                                                M19FSP
| O:062                                                              +--TON------------+
|--|/|---------------------------------------------------------------|TIMER ON DELAY   |-(EN)-
|   12                                                               |TIMER:    T4:239 |
|[320]                                                               |BASE (SEC): 0.01 |-(DN)
|                                                                    |PRESET:      100 |
|                                                                    |ACCUM:         0 |
|                                                                    +-----------------+
T4:239.TT - -| |- - File #2 MAIN_PRGRM - 319
```

Rung #322

```
|                                   PAUSE
|                                   PALLET IN
| MANUAL MOTOR  DOOR 11             EXITBUFFER                      MOTOR 19
| 19 ON         OPEN                MOTOR 19                        SLOW
| MM19ON        DROP11S             M19PXB                          M19S
|     N7:24       I:056               B3                             O:063
|------| |--------| |--------------+---|/|--------------------------+---( )---
|       1           05             |   409                          |   02
|  [529]                           |  [628]                         |
|               |PALLET            |                                |
|               |DETECTED          |  O:063/02 - -|/|- - File #2 MAIN_PRGRM - 323
|               |RIGHT SIDE        |  T4:259.TT - -| |- - File #2 MAIN_PRGRM - 319
|               |EXBUFFER          |                                |MOTOR 19
|               |SEN51             |                                |SLOW PULSE
|               |   I:053          |                                |M19SP
|               +----|/|-----------+                                +--TON------------+
|                     13                                            |TIMER ON DELAY   |-(EN)-
|                                                                   |TIMER:    T4:259 |
|                                                                   |BASE (SEC): 0.01 |-(DN)
|                                                                   |PRESET:      100 |
|                                                                   |ACCUM:         0 |
| |MOTOR 19    DOOR 9    DOOR 10                                    +-----------------+
| |REVERSE     OPEN      OPEN
| |M19R        DROP9S    DROP10S
| |  B3        I:056     I:056
| +--| |--+----| |-------| |------+
|    119  |     01        03      |
|  [586]  |                       |
|         |PALLET                 |
|         |DETECTED               |
|         |LEFT SIDE              |
|         |EXBUFFER               |
|         |SEN49                  |
|         |   I:053               |
|         +----|/|----------------+
|               11
```

Rung #323

```
|                                                                    MOTOR 19
|MOTOR 19                                                            SLOW STOP
|SLOW                                                                PULSE
|M19S                                                                M19SSP
| O:063                                                              +--TON------------+
|--|/|---------------------------------------------------------------|TIMER ON DELAY   |-(EN)-
|   02                                                               |TIMER:    T4:279 |
|[322]                                                               |BASE (SEC): 0.01 |-(DN)
|                                                                    |PRESET:      100 |
|                                                                    |ACCUM:       101 |
|                                                                    +-----------------+
T4:279.TT - -| |- - File #2 MAIN_PRGRM - 319
```

Rung #312

```
AUTO MODE ENABLE AUTO          N7:37   11    [158]
PALLET DETECTED RIGHT SIDE CARBON SEN42    I:053  02
PALLET DETECTED RIGHT SIDE DWELL 6 SEN45   I:053  -|/|-  05
PAUSE PALLET IN DWELL 6 MOTOR 17 M17PD6    B3  -|/|-  408   [628]
MOTOR 17 SLOW M17S                         O:063  -( )-  00

PALLET DETECTED LEFT SIDE DWELL 6 SEN43    I:053  03

O:063/00 - -| |- - File #2 MAIN_PRGRM - 306
           -|/|- - File #2 MAIN_PRGRM - 313
T4:257.TT - -| |- - File #2 MAIN_PRGRM - 309

MOTOR 17 SLOW PULSE M17SP
TON
TIMER ON DELAY        -(EN)-
TIMER:        T4:257
BASE (SEC):     0.01  -(DN)
PRESET:          100
ACCUM:             0

MANUAL MOTOR 17 ON MM17ON                  N7:23   15    [527]
DOOR 9 OPEN DROP9S                         I:056   01
DOOR 10 OPEN DROP10S                       I:056   03
PALLET DETECTED RIGHT SIDE BUFFER 4 SEN48  I:053  -|/|-  10
MOTOR 17 REVERSE M17R                      B3     117    [584]
```

Rung #313

```
MOTOR 17 SLOW M17S                         O:063  -|/|-  00   [312]

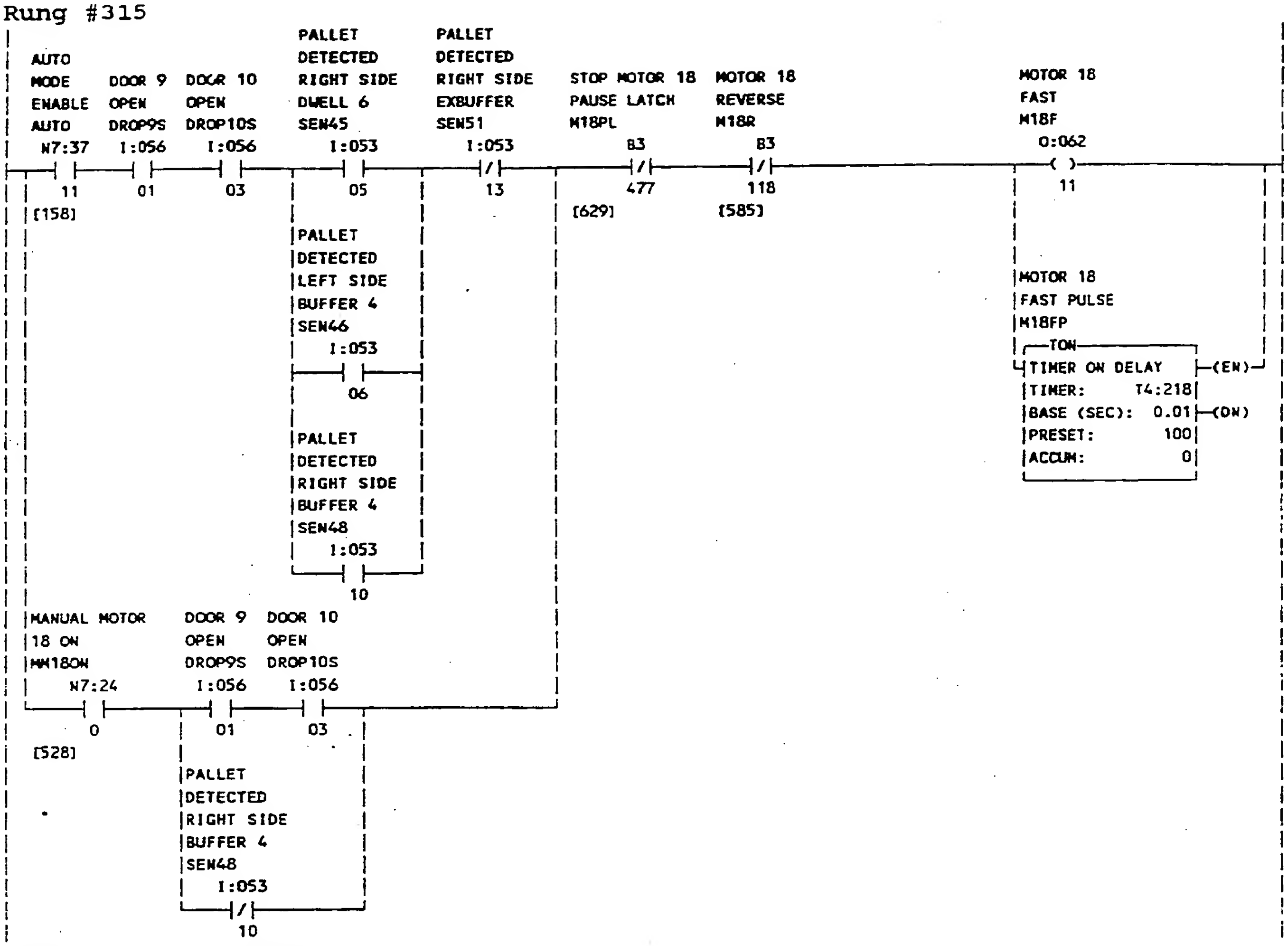
MOTOR 17 SLOW STOP PULSE M17SSP
TON
TIMER ON DELAY        -(EN)-
TIMER:        T4:277
BASE (SEC):     0.01  -(DN)
PRESET:          100
ACCUM:           102

T4:277.TT - -| |- - File #2 MAIN_PRGRM -  309
```

Rung #314

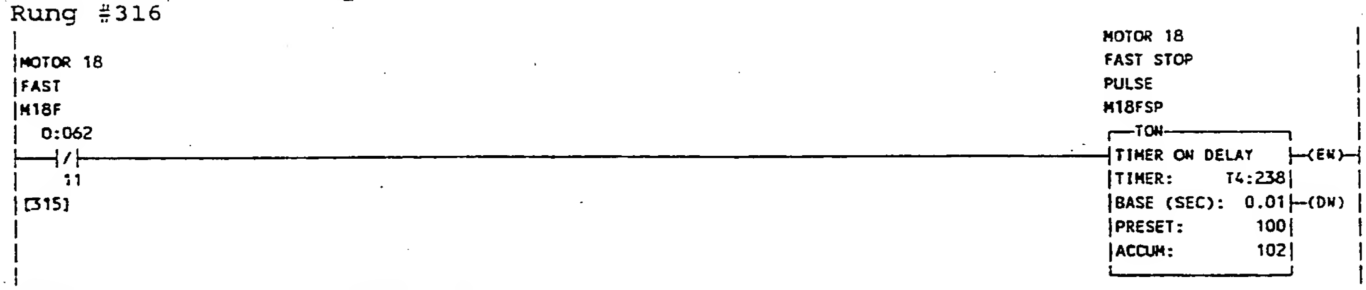
```
|                                                                      MOTOR 18 |
|            MOTOR DRIVE                                               INTERRUPT|
|            PULSER                                                             |
| M18FP      MDP                                                       M18I     |
| T4:218      B3                                                        O:062   |
|--+--] [--+---] [----------------------------------------------------( )-----|
|  |  TT   |   299                                                     01      |
|  |[315]  | [14]                                                              |
|  |M18FSP |                                                                   |
|  | T4:238|                                                                   |
|  |--] [--|                                                                   |
|  |  TT   |                                                                   |
|  |[316]  |                                                                   |
|  |M18SP  |                                                                   |
|  |T4:258 |                                                                   |
|  |--] [--|                                                                   |
|  |  TT   |                                                                   |
|  |[317]  |                                                                   |
|  |M18SSP |                                                                   |
|  | T4:278|                                                                   |
|  +--] [--+                                                                   |
|     TT                                                                       |
|   [318]                                                                      |
```

Rung #315



O:062/11 - -| |- - File #5 FAULTS - 12
-|/|- - File #2 MAIN_PRGRM - 316
-( )- - File #2 MAIN_PRGRM - 315
T4:218.TT - -| |- - File #2 MAIN_PRGRM - 314

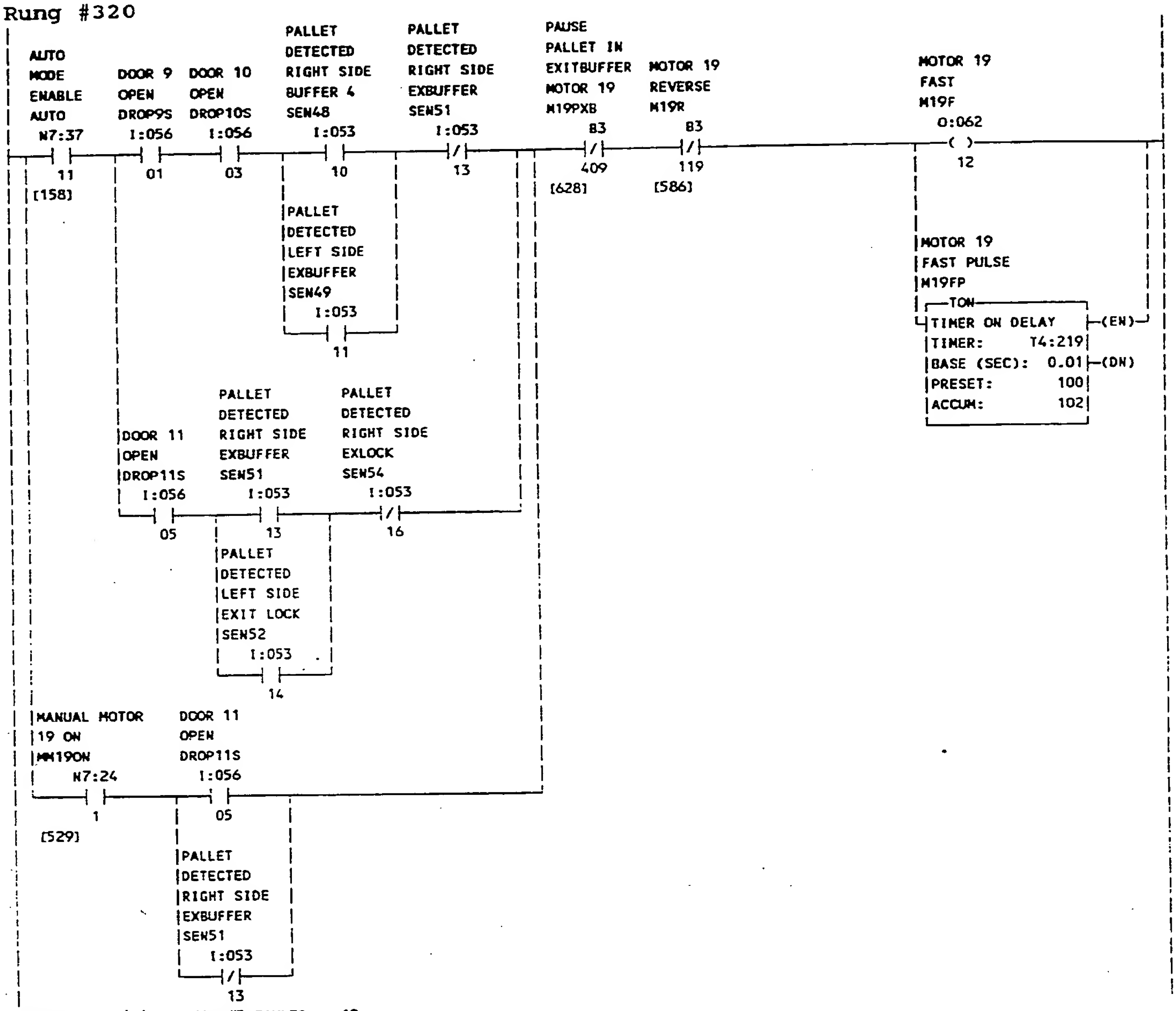
Rung #316



T4:238.TT - -| |- - File #2 MAIN_PRGRM - 314

```
Rung #317
 MANUAL MOTOR      DOOR 9   DOOR 10                                   MOTOR 18
 18 ON             OPEN     OPEN                                      SLOW
 MM18ON            DROP9S   DROP10S                                   M18S
   N7:24           I:056    I:056                                       O:063
 --] [------------] [------] [----------------------------------------+--( )--
    0              01       03                                        |   01
 [528]                                                                |
                   PALLET              O:063/01 - ]/[ - File #2 MAIN_PRGRM - 318
                   DETECTED            T4:258.TT - ] [ - File #2 MAIN_PRGRM - 314
                   RIGHT SIDE                                         |
                   BUFFER 4                                           MOTOR 18
                   SEN48                                              SLOW PULSE
                     I:053                                            M18SP
                   --]/[--                                            +-TON--------------+
                     10                                               |TIMER ON DELAY    |-(EN)-
                                                                      |TIMER:     T4:258 |
                                                                      |BASE (SEC):  0.01 |-(DN)
                                                                      |PRESET:       100 |
 MOTOR 18                                                             |ACCUM:          0 |
 REVERSE                                                              +------------------+
 M18R
   B3
 --] [--
   118
 [585]
Rung #318
 MOTOR 18                                                             MOTOR 18
 SLOW                                                                 SLOW STOP
 M18S                                                                 PULSE
  O:063                                                               M18SSP
 --]/[----------------------------------------------------------------+-TON--------------+
   01                                                                 |TIMER ON DELAY    |-(EN)-
 [317]                                                                |TIMER:     T4:278 |
                                                                      |BASE (SEC):  0.01 |-(DN)
                                                                      |PRESET:       100 |
                                                                      |ACCUM:        101 |
                                                                      +------------------+
T4:278.TT - ] [ - File #2 MAIN_PRGRM - 314
Rung #319
                 MOTOR DRIVE                                          MOTOR 19
                 PULSER                                               INTERRUPT
  M19FP          MDP                                                  M19I
  T4:219         B3                                                     O:062
 --] [-----------] [------------------------------------------------------( )--
    TT           299                                                     02
  [320]         [14]
  M19FSP
  T4:239
 --] [--
    TT
  [321]
  M19SP
  T4:259
 --] [--
    TT
  [322]
  M19SSP
  T4:279
 --] [--
    TT
  [323]
```

Rung #320



O:062/12 - -| |- - File #5 FAULTS - 12
-|/|- - File #2 MAIN_PRGRM - 321
-( )- - File #2 MAIN_PRGRM - 320
T4:219.TT - -| |- - File #2 MAIN_PRGRM - 319

Rung #324

```
| PUMPDOWN                                                         EXITLOCK
| SYSTEM                                                           HIVAC BAFFLE
| ENABLE                                                           ENABLE
| PDSE                                                             HV12_3
|    B3                                                              O:061
|---] [------------------------------------------------------------------(L)----|
| | 303                                                                  17
| |[23]
| |                  | O:061/17 - -(U)- - File #2 MAIN_PRGRM - 139
| |                  | T4:39.DN - -] [- - File #2 MAIN_PRGRM - 326
| |     PALLET            PALLET                                 |DOOR 10
| |AUTO  DETECTED          DETECTED                              |DELAY TIMER
| |MODE  CENTER   DOOR 11  RIGHT SIDE                            |DR10DT
| |ENABLE DWELL 6 CLOSED   EXBUFFER                              |+-TON-----------+
| |AUTO  SEN44    DRCL11S  SEN51                                 +|TIMER ON DELAY |-(EN)-
| | N7:37  I:053   I:056   I:053                                  |TIMER:    T4:39|
| |--] [---] [-----] [-----]/[--                                  |BASE (SEC):  1.0|-(DN)
| |  11     04      04      13                                    |PRESET:       5|
| |[158]                                                          |ACCUM:        0|
| |SYSTEM
| |VENT
| |ENABLE
| |SYSVNTE
| | N7:37
| +--] [--
|     5
|  [368]
```

Rung #325

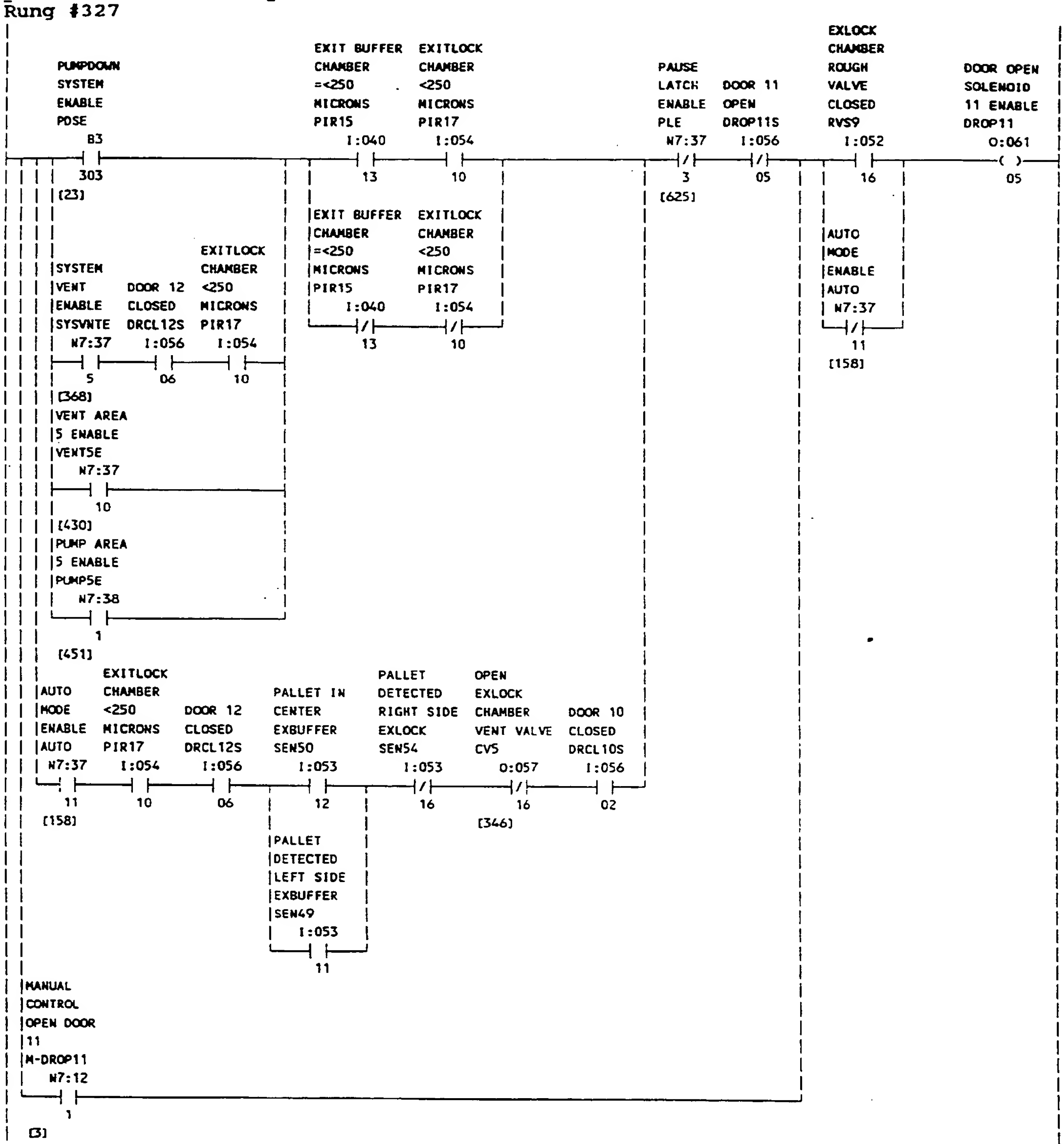
```
|                                                            DOOR OPEN
| PREPARE FOR  DOOR 9                                        SOLENOID
| AUTO RUN     OPEN                                          9 ENABLE
| >AUTO        DROP9S                                        DROP9
|    N7:37      I:056                                         O:061
|----] [--------]/[---------------------------------------------( )--------|
| |    1         01                                              01
| |[162]
| |                     | O:061/01 - -] [- - File #2 MAIN_PRGRM - 325
| |                     |                    File #5 FAULTS - 57          |MANUAL
| |MANUAL    EXIT BUFFER  CARBON                                          |CONTROL   DOOR OPEN  MANUAL
| |CONTROL   CHAMBER      CHAMBER                                         |OPEN DOOR SOLENOID   DOOR 9
| |OPEN DOOR =<250        =<250                                           |9         9 ENABLE   OPEN
| |9         MICRONS      MICRONS                                         |M-DROP9   DROP9      MDR9OP
| |M-DROP9   PIR15        PIR16                                           | N7:11     O:061     N7:32
| | N7:11      I:040      I:054                                           +--] [-----] [------+-(L)-
| +--] [------+--] [-------] [--+                                            15        01     |  15
|     15      |   13        07  |   File #6 TECH_RUNGS - 3                [3]      [325]      |
|  [3]        |                 |   N7:32/15 - -(U)- - File #2 MAIN_PRGRM - 329               |MANUAL
|             |EXIT BUFFER CARBON   _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2               |DOOR 9
|             |CHAMBER     CHAMBER  N7:32/3 - -(L)- - File #2 MAIN_PRGRM - 329                |CLOSE
|             |=<250       =<250    _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2               |MDR9CL
|             |MICRONS     MICRONS                                                            | N7:32
|             |PIR15       PIR16                                                              +-(U)-
|             |  I:040      I:054                                                                3
|             +--]/[-------]/[--+
|                13          07
```

```
Rung #326
                          PAUSE                                                                  DOOR OPEN
                          LATCH      DOOR 10                                                     SOLENOID
      DOOR 9 DELAY        ENABLE     OPEN                                                        10 ENABLE
      DR10DT              PLE        DROP10S                                                     DROP10
          T4:39           N7:37        I:056                                                       O:061
|-------] [-------------]/[--------]/[-------------------------------------------------------------( )---|
          DN               3            03                                                          03
     [324]               [625]
                                                                                 MANUAL
                                                                                 CONTROL      DOOR OPEN     MANUAL
                                                                                 OPEN DOOR    SOLENOID      DOOR 10
     PUMPDOWN                                                                    10           10 ENABLE     OPEN
     SYSTEM                                                                      M-DROP10     DROP10        MDR10OP
     ENABLE                                                                        N7:12        O:061         N7:33
     PDSE                                                                      |---] [--------] [--------+---(L)---
         B3                                                                         0            03      |     0
     |---] [----------|                                                          [3]          [326]      |
         303                                                                                             | MANUAL
     [23]                                                                                                | DOOR 10
                                                                                                         | CLOSE
                                                                                                         | MDR10CL
     SYSTEM                                                                                              |   N7:32
     VENT                                                                                                +---(U)---
     ENABLE                                                                                                    4
     SYSVNTE
       N7:37
     |---] [----------|
          5
     [368]
     PSENDPULSE
       T4:128
     |---] [----------|
          TT
     [454]
   MANUAL
   CONTROL       EXIT BUFFER    CARBON
   OPEN DOOR     CHAMBER        CHAMBER
   10            =<250          =<250
   M-DROP10      MICRONS        MICRONS
                 PIR15          PIR16
     N7:12         I:040          I:054
   |---] [----+----] [-----------] [----|
        0     |     13              07
   [3]        |
              | EXIT BUFFER    CARBON
              | CHAMBER        CHAMBER
              | =<250          =<250
              | MICRONS        MICRONS
              | PIR15          PIR16
              |   I:040          I:054
              +----]/[-----------]/[----+
                    13              07

O:061/03 - -] [- - File #2 MAIN_PRGRM -  326
                   File #5 FAULTS -  59
                   File #6 TECH_RUNGS -  3
         -( )- - File #2 MAIN_PRGRM -  326
N7:33/0 - -(L)- - File #2 MAIN_PRGRM -  326
        -(U)- - File #2 MAIN_PRGRM -  335
_F:N7:211X21 - BTW - File #2 MAIN_PRGRM -  2
N7:32/4 - -(L)- - File #2 MAIN_PRGRM -  335
        -(U)- - File #2 MAIN_PRGRM -  326
```

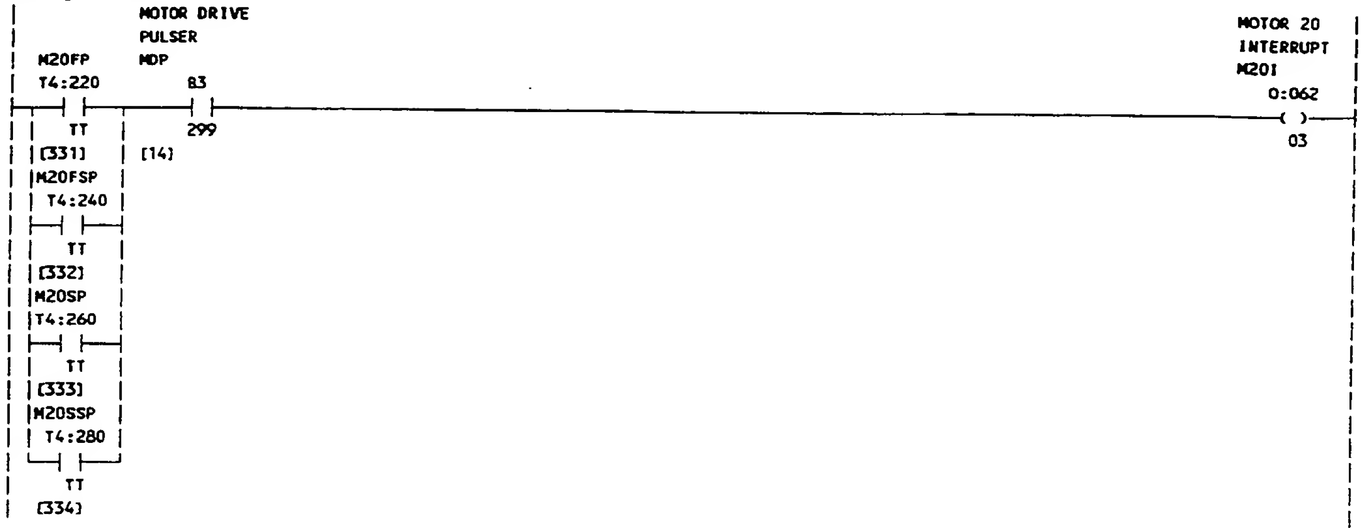
_F:N7:21(X21 - BTW - File #2 MAIN_PRG 2

Rung #327



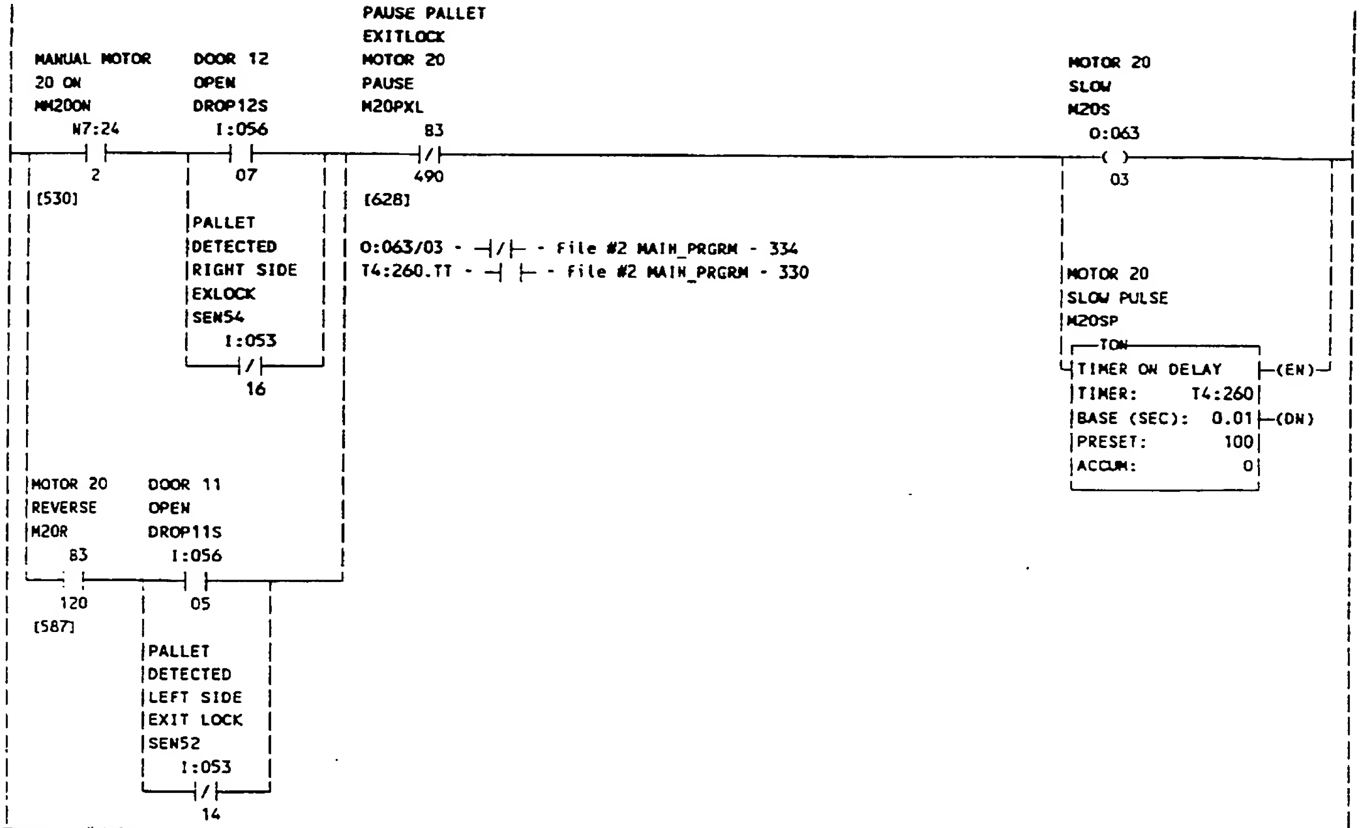
```
O:061/05 - -| |- - File #5 FAULTS -  t
                   File #6 TECH_RUNGS -  3
          -( )- - File #2 MAIN_PRGRM -  327
Rung #328
|              PALLET      PALLET                                              |
| PALLET IN    DETECTED    DETECTED                                            |
| CENTER       RIGHT SIDE  LEFT SIDE                                PALLET AT  |
| BUFFER 4     BUFFER 4    EXBUFFER                                 DOOR 9 AND 10 |
| SEN47        SEN48       SEN49                                    PLT_DR9,10 |
|   I:053        I:053       I:053                                     B3      |
|-+---] [---+----] [---------] [-------------------------------------( )-------|
| |   07    |      10          11                                      298     |
| |         | B3/298 - -|/|- - File #2 MAIN_PRGRM - 329, 335                    |
| |PALLET IN|                                                                   |
| |CENTER   |                                                                   |
| |EXBUFFER |                                                                   |
| |SEN50    |                                                                   |
| |  I:053  |                                                                   |
| +---] [---+                                                                   |
|     12                                                                        |
Rung #329
| MANUAL                                                   CLOSE               |
| CONTROL                                                  DOOR 9              |
| CLOSE DOOR   PALLET AT                                   SOLENOID            |
| 9            DOOR 9 AND 10                               ENABLE              |
| M-DRCL9      PLT_DR9,10                                  DRCL9               |
|   N7:11          B3                                        O:061             |
|-+---] [---+-----]/[-------------------------------------+-----( )----------+-|
| |   3     |     298                                     |      00          | |
| | [3]     | [328]                                       |                  | |
| |         |                                             |MANUAL            | |
| |         | O:061/00 - -| |- - File #5 FAULTS - 33      |CONTROL     MANUAL| |
| |         |                  File #6 TECH_RUNGS - 3      |CLOSE DOOR PALLET AT DOOR 9 | |
| |         | N7:32/15 - -(L)- - File #2 MAIN_PRGRM - 325  |9       DOOR 9 AND 10 OPEN | |
| |VENT AREA| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2  |M-DRCL9  PLT_DR9,10 MDR9OP | |
| |4 ENABLE | N7:32/3 - -(U)- - File #2 MAIN_PRGRM - 325   |  N7:11     B3      N7:32 | |
| |VENT4E   | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2  +---] [-----]/[---+--(U)--+ |
| |  N7:37  |                                                 3       298    |   15  |   |
| +---] [---+                                               [3]     [328]    |       |   |
|     9                                                                      |       |   |
| [425]                                                                      |MANUAL |   |
|                                                                            |DOOR 9 |   |
|                                                                            |CLOSE  |   |
|                                                                            |MDR9CL |   |
|                                                                            | N7:32 |   |
|                                                                            +--(L)--+   |
|                                                                                3        |
```

Rung #330

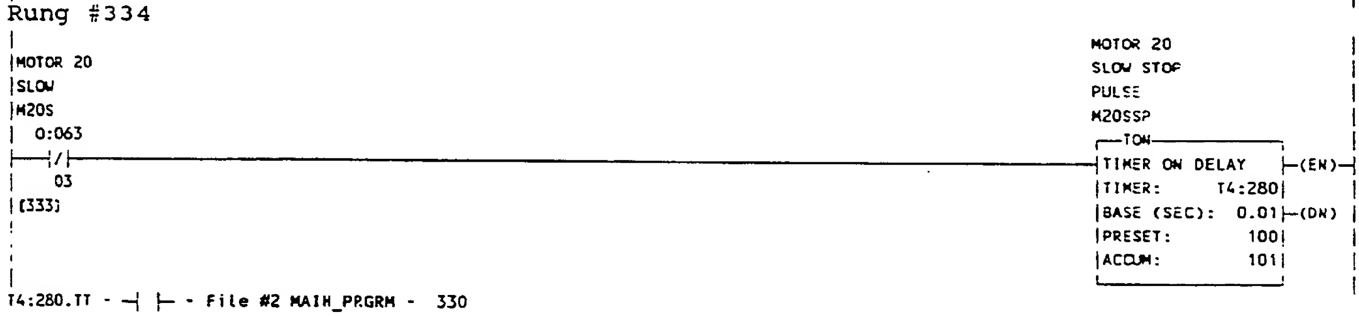

MOTOR DRIVE
PULSER
M20FP
T4:220
MDP
B3
TT
299
[331]
[14]
M20FSP
T4:240
TT
[332]
M20SP
T4:260
TT
[333]
M20SSP
T4:280
TT
[334]
MOTOR 20
INTERRUPT
M20I
O:062
03

```
Rung #331
|                                PALLET        PALLET              PAUSE PALLET
| AUTO                           DETECTED      DETECTED            EXITLOCK
| MODE        DOOR 11            RIGHT SIDE    RIGHT SIDE          MOTOR 20      MOTOR 20                    MOTOR 20
| ENABLE      OPEN               EXBUFFER      EXLOCK              PAUSE         REVERSE                     FAST
| AUTO        DROP11S            SEN51         SEN54               M20PXL        M20R                        M20F
|  N7:37        I:056             I:053         I:053                 B3            B3                        O:062
+-+--] [------+--] [----+--------] [----+-------]/[--------+-+--------]/[-----------]/[------------------+------( )------+-+
| |   11      |   05    |         13    |        16        | |       490           120                  |      13       | |
| |[158]      |         |               |                  | |     [628]          [587]                 |               | |
| |           |         |PALLET         |                  | |                                          |               | |
| |           |         |DETECTED       |                  | |                                          |               | |
| |           |         |LEFT SIDE      |                  | |                                          |MOTOR 20       | |
| |           |         |EXIT LOCK      |                  | |                                          |FAST PULSE     | |
| |           |         |SEN52          |                  | |                                          |M20FP          | |
| |           |         |   I:053       |                  | |                                          |+-TON-------------+ |
| |           |         +---] [---------+                  | |                                          +|TIMER ON DELAY   |-(EN)-+
| |           |            14                              | |                                           |TIMER:    T4:220 |
| |           |                                            | |                                           |BASE (SEC):  0.01|-(DN)
| |           |                   PALLET       PALLET      | |                                           |PRESET:       100|
| |           |                   DETECTED     DETECTED    | |                                           |ACCUM:          0|
| |           |DOOR 12   DOOR 11  RIGHT SIDE   RIGHT SIDE  | |                                           +-----------------+
| |           |OPEN      CLOSED   EXLOCK       EXIT END    | |
| |           |DROP12S   DRCL11S  SEN54        SEN57       | |
| |           |  I:056    I:056    I:053        I:054      | |
| |           +---] [------] [------] [----------]/[-------+ |
| |               07       04       16           17          |
| |MANUAL MOTOR     DOOR 12                                   |
| |20 ON            OPEN                                      |
| |MM20ON           DROP12S                                   |
| |   N7:24          I:056                                    |
| +----] [-------+----] [----+------------------------------+
|       2        |     07    |
| [530]          |           |
|                |PALLET     |
|                |DETECTED   |
|                |RIGHT SIDE |
|                |EXLOCK     |
|                |SEN54      |
|                |   I:053   |
|                +----]/[----+
|                      16
O:062/13 - ] [ - - File #5 FAULTS -   13
           ]/[ - - File #2 MAIN_PRGRM -   332
           -( )- - File #2 MAIN_PRGRM -   331
T4:220.TT - ] [ - - File #2 MAIN_PRGRM -   330
Rung #332
|                                                                                  MOTOR 20
|MOTOR 20                                                                          FAST STOP
|FAST                                                                              PULSE
|M20F                                                                              M20FSP
| O:062                                                                            +-TON-------------+
+--]/[-----------------------------------------------------------------------------|TIMER ON DELAY   |-(EN)-
|   13                                                                             |TIMER:    T4:240 |
|[331]                                                                             |BASE (SEC):  0.01|-(DN)
|                                                                                  |PRESET:       100|
|                                                                                  |ACCUM:        102|
|                                                                                  +-----------------+
T4:240.TT - ] [ - - File #2 MAIN_PRGRM -   330
```

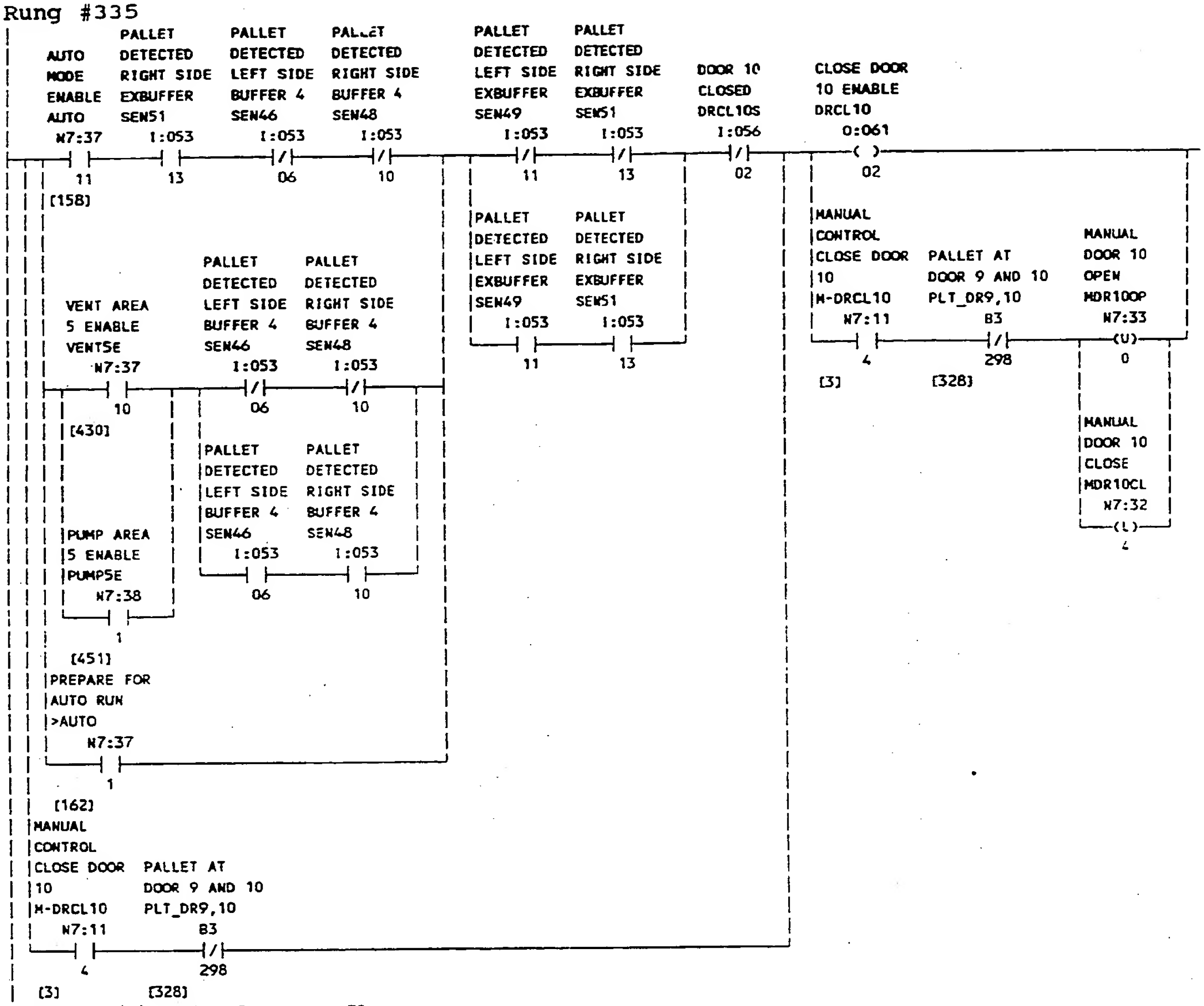
Rung #333



Rung #334



Rung #335



O:061/02 - -| |- - File #5 FAULTS - 35
File #6 TECH_RUNGS - 3
-( )- - File #2 MAIN_PRGRM - 335
N7:33/0 - -(L)- - File #2 MAIN_PRGRM - 326
-(U)- - File #2 MAIN_PRGRM - 335
_F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2
N7:32/4 - -(L)- - File #2 MAIN_PRGRM - 335
-(U)- - File #2 MAIN_PRGRM - 326
_F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2

```
Rung #336
|
|                PALLET      PALLET                                                                         |
| PALLET IN      DETECTED    DETECTED                                                                       |
| CENTER         RIGHT SIDE  LEFT SIDE                                                          PALLET AT   |
| EXBUFFER       EXBUFFER    EXIT LOCK                                                          DOOR 11     |
| SEN50          SEN51       SEN52                                                              PLT_DR11    |
|    I:053          I:053       I:053                                                             B3        |
|-+----] [----+-----] [---------] [--------------------------------------------------------------( )-------|
| |    12     |     13          14                                                               300        |
| |PALLET     | B3/300 - -|/|- - File #2 MAIN_PRGRM - 337                                                   |
| |DETECTED   |                                                                                             |
| |CENTER     |                                                                                             |
| |EXIT LOCK  |                                                                                             |
| |SEN53      |                                                                                             |
| |   I:053   |                                                                                             |
| +----] [----+                                                                                             |
|      15                                                                                                   |
```

Rung #337

```
|            PALLET        PALLET       PALLET         PALLET       PALLET
|   AUTO     DETECTED      DETECTED     DETECTED       DETECTED     DETECTED
|   MODE     RIGHT SIDE    LEFT SIDE    RIGHT SIDE     LEFT SIDE    RIGHT SIDE   DOOR 11      CLOSE
|   ENABLE   EXLOCK        EXBUFFER     EXBUFFER       EXIT LOCK    EXLOCK       CLOSED       DOOR 11
|   AUTO     SEN54         SEN49        SEN51          SEN52        SEN54        DRCL11S      DRCL11
|    N7:37     I:053          I:053        I:053          I:053        I:053       I:056        O:061
|---] [--------] [------+------] [--------] [------+------] [--------] [------+-----]/[----+-------( )----
| | |  11        16     |      11           13     |      14           16     |     04     |       04
| | |[158]              |                          |                          |            |
| | |                   |PALLET       PALLET       |PALLET       PALLET       |            |MANUAL
| | |                   |DETECTED     DETECTED     |DETECTED     DETECTED     |            |CONTROL                    MANUAL
| | |                   |LEFT SIDE    RIGHT SIDE   |LEFT SIDE    RIGHT SIDE   |            |CLOSE DOOR  PALLET AT      DOOR 11
| | |                   |EXBUFFER     EXBUFFER     |EXIT LOCK    EXLOCK       |            |11          DOOR 11        OPEN
| | |PREPARE FOR        |SEN49        SEN51        |SEN52        SEN54        |            |M-DRCL11    PLT_DR11       MDR11OP
| | |AUTO RUN           |   I:053        I:053     |   I:053        I:053     |            |  N7:11        B3          N7:33
| | |>AUTO              +-----]/[--------]/[-------+-----]/[--------]/[-------+            +----] [--------]/[-----+-----(U)----
| | |   N7:37                11           13              14           16                  |     5          300    |      1
| | +-----] [-----------+                                                                  | [3]          [336]    |
| | |      1            |                                                                  |                       |MANUAL
| | |[162]              |                                                                  |                       |DOOR 11
| | |                   |                                                                  |                       |CLOSE
| | |                   |                                                                  |                       |MDR11CL
| | |                   |                                                                  |                       |  N7:32
| | |VENT               |                                                                  |                       +-----(L)----
| | |EXIT LOCK          |                                                                  |                             5
| | |VNTEX              |                                                                  |
| | |   N7:27           |                                                                  |
| | +-----] [-----------+                                                                  |
| | |     8             |                                                                  |
| | |[688]              |                                                                  |
| | |PUMPDOWN           |                                                                  |
| | |EXIT LOCK          |                                                                  |
| | |CLEAN CYCLE        |                                                                  |
| | |PD-EX-CC           |                                                                  |
| | |     B3            |                                                                  |
| | +-----] [-----------+                                                                  |
| |      497                                                                               |
| |  [692]                                                                                 |
| |MANUAL                                                                                  |
| |CONTROL                                                                                 |
| |CLOSE DOOR  PALLET AT                                                                   |
| |11          DOOR 11                                                                     |
| |M-DRCL11    PLT_DR11                                                                    |
| |  N7:11        B3                                                                       |
| +----] [--------]/[----------------------------------------------------------------------+
|      5          300
| [3]          [336]
```

```
O:061/04 - -] [- - File #5 FAULTS -   37
                   File #6 TECH_RUNGS -  3
            -( )- - File #2 MAIN_PRGRM -  337
_F:N7:21L%21 - BTW - File #2 MAIN_PRGRM -  2
_F:N7:21L%21 - BTW - File #2 MAIN_PRGRM -  2
```

```
Rung #338
|                                                                    EXIT LOCK |
|                                                                    AUTO      |
| AUTOPULSE                                                          EXLK_AUTO |
|   T4:282                                                           B3        |
|-+---] [---+---------------------------------------------------------(L)------|
| |   TT    |                                                          345     |
| |[158]    |                                                                  |
| |         | B3/345 - ] [ - File #2 MAIN_PRGRM - 340, 353                     |
| |         |          -(U)- - File #2 MAIN_PRGRM - 339                        |
| |         COMPUTER                                                           |
| |AUTO     SIGNAL FOR                                                         |
| |MODE     AUTO MODE                                                         |
| |ENABLE   OK                                                                 |
| |AUTO     COMPAUTO                                                           |
| | N7:37     N7:16                                                            |
| +--] [-------] [--+                                                          |
|    11        11                                                              |
| [158]     [3]                                                                |
Rung #339
| VENT-PUMP                                                                    |
| CYCLE EXIT                                                         EXIT LOCK |
| LOCK                                                               AUTO      |
| VNT-PD-EX                                                          EXLK_AUTO |
|    N7:27                                                           B3        |
|-+---] [---+---------------------------------------------------------(U)------|
| |    9    |                                                          345     |
| |[690]    |                                                                  |
| |         | B3/345 - ] [ - File #2 MAIN_PRGRM - 340, 353                     |
| |         |          -(L)- - File #2 MAIN_PRGRM - 338                        |
| |VENT     |                                                                  |
| |EXIT LOCK|                                                                  |
| |VNTEX    |                                                                  |
| |  N7:27  |                                                                  |
| +---] [---+                                                                  |
| |    8    |                                                                  |
| |[688]    |                                                                  |
| |AUTO MODE|                                                                  |
| |DISABLE  |                                                                  |
| |TS10     |                                                                  |
| |  N7:16  |                                                                  |
| +---] [---+                                                                  |
|      2                                                                       |
| [3]                                                                          |
```

```
Rung #340
     OPEN                                    EXITLOCK                 OPEN                  MECHANICAL        OPEN
     ROUGHING                                CHAMBER                  EXLOCK                PUMP 3            EXLOCK
     VALVES                                  <250       BLOWER 3      CHAMBER     DOOR 12   ISOLATION         ROUGH
     1->5                                    MICRONS    ENABLED       VENT VALVE  CLOSED    VALVE OPEN        VALVE
     OP_RV1->5                               PIR17      BL3           CVS         DRCL12S   MP3IVOP           RV5
       B3                                    I:054      O:057         O:057       I:056     I:055             O:060
 ---] [--------------------------------------]/[--------] [-----------]/[---------] [--------] [----------------( )--
       309                                   10         01            16          06        14                12
   [104]                                                [100]         [346]
                                      PALLET
                                      DETECTED
   EXIT LOCK  DOOR 11  DOOR 12  RIGHT SIDE
   AUTO       CLOSED   CLOSED   EXLOCK
   EXLK_AUTO  DRCL11S  DRCL12S  SENS4
     B3       I:056    I:056    I:053
 ---] [-------] [------] [------]/[---
     345      04       06       16
   [339]
   PUMPDOWN
   EXIT LOCK
   CLEAN CYCLE
   PD-EX-CC
     B3
 ---] [-------------------------------
     497
   [692]
   PUMP DOWN
   EXIT LOCK
   PDEX
     N7:27
 ---] [-------------------------------
     10
   [698]
                            EXIT BUFFER
                            CHAMBER
 PUMP AREA   OPEN ROUGH     =<250
 5 ENABLE    VALVE 5 DELAY  MICRONS
 PUMP5E      T5RVTMR        PIR15
   N7:38       T4:4          I:040
 ---] [--------] [------------]/[-----
     1          DN            13
 [451]       [456]
 MANUAL ROUGH
 PUMP VALVE
 5 OPEN
 MRVP5OP
     N7:28
 ---] [-------------------------------
     4
 [507]
O:060/12 - ] [ - - File #2 MAIN_PRGRM -  341
                   File #5 FAULTS -  175
                   File #6 TECH_RUNGS -  0
          ]/[ - - File #5 FAULTS -  177
          ( )- - File #2 MAIN_PRGRM -  340
```

```
Rung #341
|         OPEN
|AUTO     EXLOCK                                                        EXIT LOCK
|MODE     ROUGH                                                         ROUGHING
|ENABLE   VALVE                                                         TIMER
|AUTO     RVS                                                           EXRUFFTMR
| N7:37   O:060                                                        ┌─TON──────────────┐
├──┤ ├────┤ ├──────────────────────────────────────────────────────────┤TIMER ON DELAY    ├─(EN)─┤
|  11      12                                                          |TIMER:     T4:166|
|[158]    [340]                                                        |BASE (SEC):   1.0├─(DN)
|                                                                      |PRESET:        60|
|                                                                      |ACCUM:          0|
|                                                                      └──────────────────┘
T4:166.DN - ┤ ├ - File #2 MAIN_PRGRM -  342
Rung #342
|                                                                           EXIT LOCK
|                                                                           ROUGHING
|                                                                           >60 SEC
|EXRUFFTMR                                                                  EXLKRUFF>60S
| T4:166                                                                      B3
├──┤ ├──────────────────────────────────────────────────────────────────────(L)──────┤
|   DN                                                                        817
|[341]
B3/817 - ┤ ├ - File #2 MAIN_PRGRM -  626
        -(L)- - File #2 MAIN_PRGRM -  342
        -(U)- - File #2 MAIN_PRGRM -  343
Rung #343
|
|PAUSE                                                                      EXIT LOCK
|DISABLE                                                                    ROUGHING
|TS12                                                                       >60 SEC
| N7:16                                                                     EXLKRUFF>60S
├──┤ ├──────────────────────────────────────────────────────────────────────  B3
|   4                                                                       ─(U)──────┤
|[3]                                                                          817
B3/817 - ┤ ├ - File #2 MAIN_PRGRM -  626
        -(L)- - File #2 MAIN_PRGRM -  342
        -(U)- - File #2 MAIN_PRGRM -  343
Rung #344
|
|VENT 5                                                                VENT 5 STAGE1
|STAGE 1                                                               VENT 5 DELAY
|V5ST1                                                                 TIMER
| B3                                                                   V5CV5DYTMR
├──┤ ├─────────────────────────────────────────────────────────────────┌─TON──────────────┐
|  420                                                                 ┤TIMER ON DELAY    ├─(EN)─┤
|[432]                                                                 |TIMER:      T4:30|
|                                                                      |BASE (SEC):   1.0├─(DN)
|                                                                      |PRESET:         5|
|                                                                      |ACCUM:          0|
|                                                                      └──────────────────┘
T4:30.DN - ┤ ├ - File #2 MAIN_PRGRM -  346
Rung #345
|                                                                      VENT OPEN
|DOOR 11                                                               DELAY ON
|CLOSED                                                                DOOR 11
|DRCL11S                                                               CLOSE
| I:056                                                                VDOR11CL
├──┤ ├─────────────────────────────────────────────────────────────────┌─TON──────────────┐
|  04                                                                  ┤TIMER ON DELAY    ├─(EN)─┤
|                                                                      |TIMER:     T4:202|
| T4:202.DN - ┤ ├ - File #2 MAIN_PRGRM - 346                           |BASE (SEC):   1.0├─(DN)
|                                                                      |PRESET:         1|
>                                                                      |ACCUM:          1|
                                                                       >>>>>>>>>>>>>>>>>>      >
```

```
Rung #346

                                         EXLOCK
                                         CHAMBER  PALLET                                                            OPEN
    AUTO                                 ROUGH    DETECTED                                                          EXLOCK
    MODE      DOOR 11   DOOR 12          VALVE    RIGHT SIDE                                                        CHAMBER
    ENABLE    CLOSED    CLOSED           CLOSED   EXLOCK                                                            VENT VALVE
    AUTO      DRCL11S   DRCL12S          RVS9     SEN54          VDOR11CL                                           CVS
     N7:37     I:056     I:056           I:052     I:053          T4:202                                            O:057
|---] [------] [------] [------] [------] [---+---] [---+-----------------------------------------------(L)---
       11        04        06      16        16   |    DN      |                                                 16
    [158]                                         | [345]      |
                                                  |            | O:057/16 - ] [ - File #2 MAIN_PRGRM - 347
                                                  |            |                  File #6 TECH_RUNGS - 0
                                                  |EXITLOCK    |            ]/[ - File #2 MAIN_PRGRM - 67, 327, 340,
                                                  |CHAMBER     |                  368, 453, 689, 695
    CHAMBER VENT 5                                |GATE VALVE  |           -(U)- - File #2 MAIN_PRGRM - 367
    DELAY TIMER                                   |CLOSED      |
    V5CVSDYTMR                                    |HV12S1      |
       T4:30                                      |   I:054    |
  |----] [--------------------------------------+ +----] [---+
        DN                                               03
    [344]
                  EXLOCK
                  CHAMBER
                  ROUGH
    READY TO      VALVE
    VENT          CLOSED
    RTVCVDT       RVS9
      T4:0         I:052
  |----] [------] [-----------------------------+
        DN         16
    [392]
    MANUAL CONTROL
    CHAMBER VENT 5
    OPEN
    M-CV5-1
          N7:6
  |----] [--------------------------------------+
          15
    [3]
                                        EXLOCK
                                        CHAMBER
    VENT       DOOR 11   DOOR 12        PRESSUR AT
    EXIT LOCK  CLOSED    CLOSED         ATMOSPHERE
    VNTEX      DRCL11S   DRCL12S        PS6
      N7:27     I:056     I:056          I:052
|---] [------] [------] [------]/[--------------------------------+
       8         04        06             04
  [688]
               EXLOCK
               CHAMBER
    VENT       PRESSUR AT
    EXIT LOCK  ATMOSPHERE
    VNT-EX     PS6
      B3         I:052
|---] [------]/[-------------------------------------------------+
     498         04
  [694]
```

Rung #347

```
|        OPEN
|AUTO    EXLOCK
|MODE    CHAMBER      PAUSE                                              EXIT LOCK
|ENABLE  VENT VALVE   DISABLE                                            VENT TIMER
|AUTO    CVS          TS12                                               EXVNTTIMER
| N7:37    O:057       N7:16                                            +-TON--------------+
|--| |------| |---------|/|---------------------------------------------|TIMER ON DELAY    |-(EN)-|
|   11       16          4                                              |TIMER:       T4:99|
|[158]   [346]         [3]                                              |BASE (SEC):    1.0|-(DN) |
|                                                                       |PRESET:        100|
|                                                                       |ACCUM:           0|
|                                                                       +------------------+
T4:99.DN - -| |- - File #2 MAIN_PRGRM - 348
```

Rung #348

```
|
|                                                                        EXIT LOCK      |
|EXVNTTIMER                                                              VENT>30 SECS   |
|  T4:99                                                                 EXLKVNT>30SECS |
|                                                                             B3        |
|--| |--------------------------------------------------------------------------(L)-----|
|   DN                                                                        815       |
|[347]
B3/815 - -| |- - File #2 MAIN_PRGRM - 626
         -(L)- - File #2 MAIN_PRGRM - 348
         -(U)- - File #2 MAIN_PRGRM - 349
```

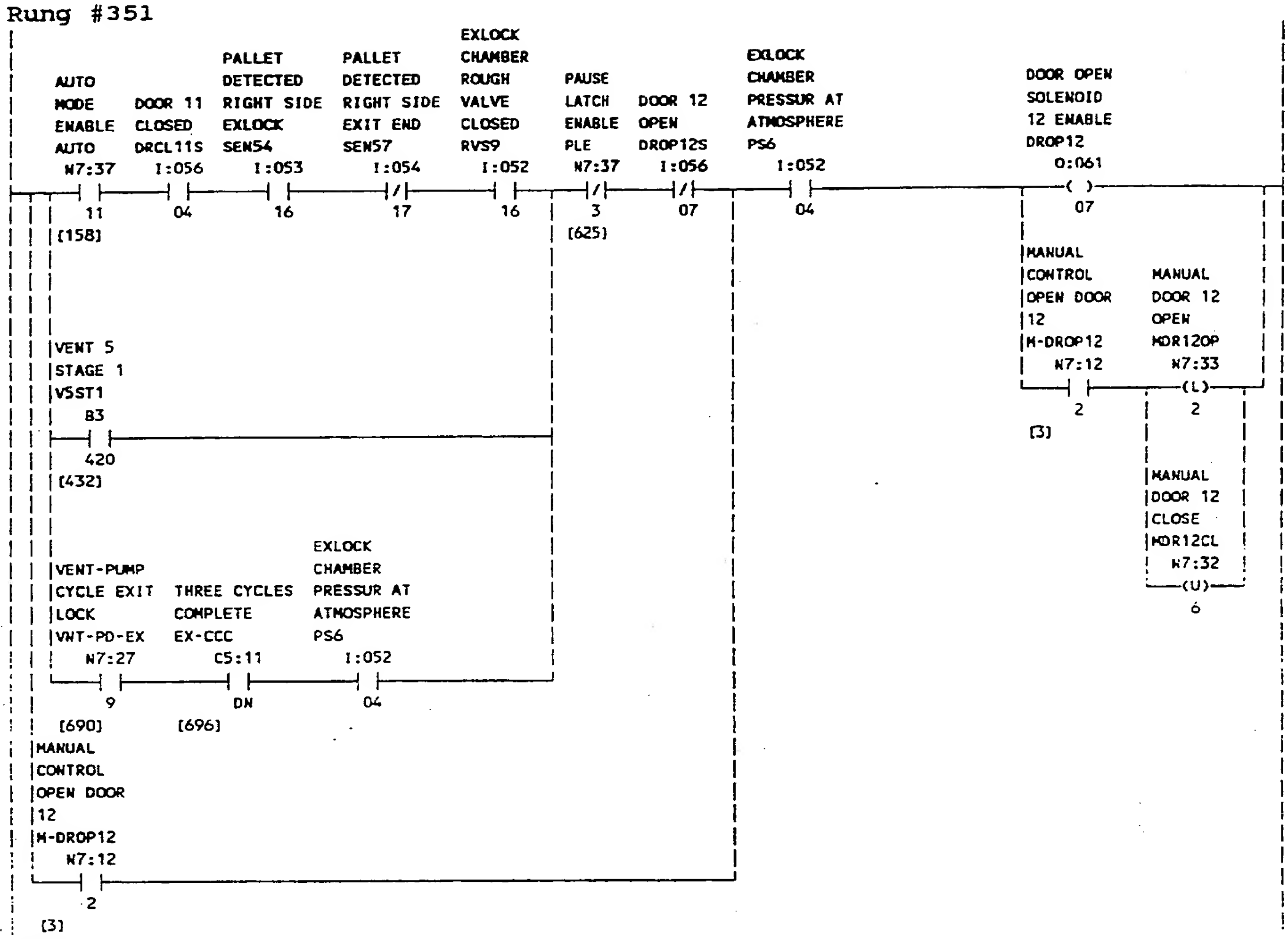
Rung #349

```
|PAUSE                                                                   EXIT LOCK      |
|DISABLE                                                                 VENT>30 SECS   |
|TS12                                                                    EXLKVNT>30SECS |
| N7:16                                                                       B3        |
|--| |--------------------------------------------------------------------------(U)-----|
|   4                                                                         815       |
|[3]
B3/815 - -| |- - File #2 MAIN_PRGRM - 626
         -(L)- - File #2 MAIN_PRGRM - 348
         -(U)- - File #2 MAIN_PRGRM - 349
```

Rung #350

```
|                                                                        EXITLOCK       |
|DOOR 12                                                                 AIR SWEEP      |
|OPEN                                                                    SOLENOID       |
|DROP12S                                                                 EXSWEEP        |
| I:056                                                                     O:061       |
|--| |--------------------------------------------------------------------------( )-----|
|   07                                                                        10        |
```

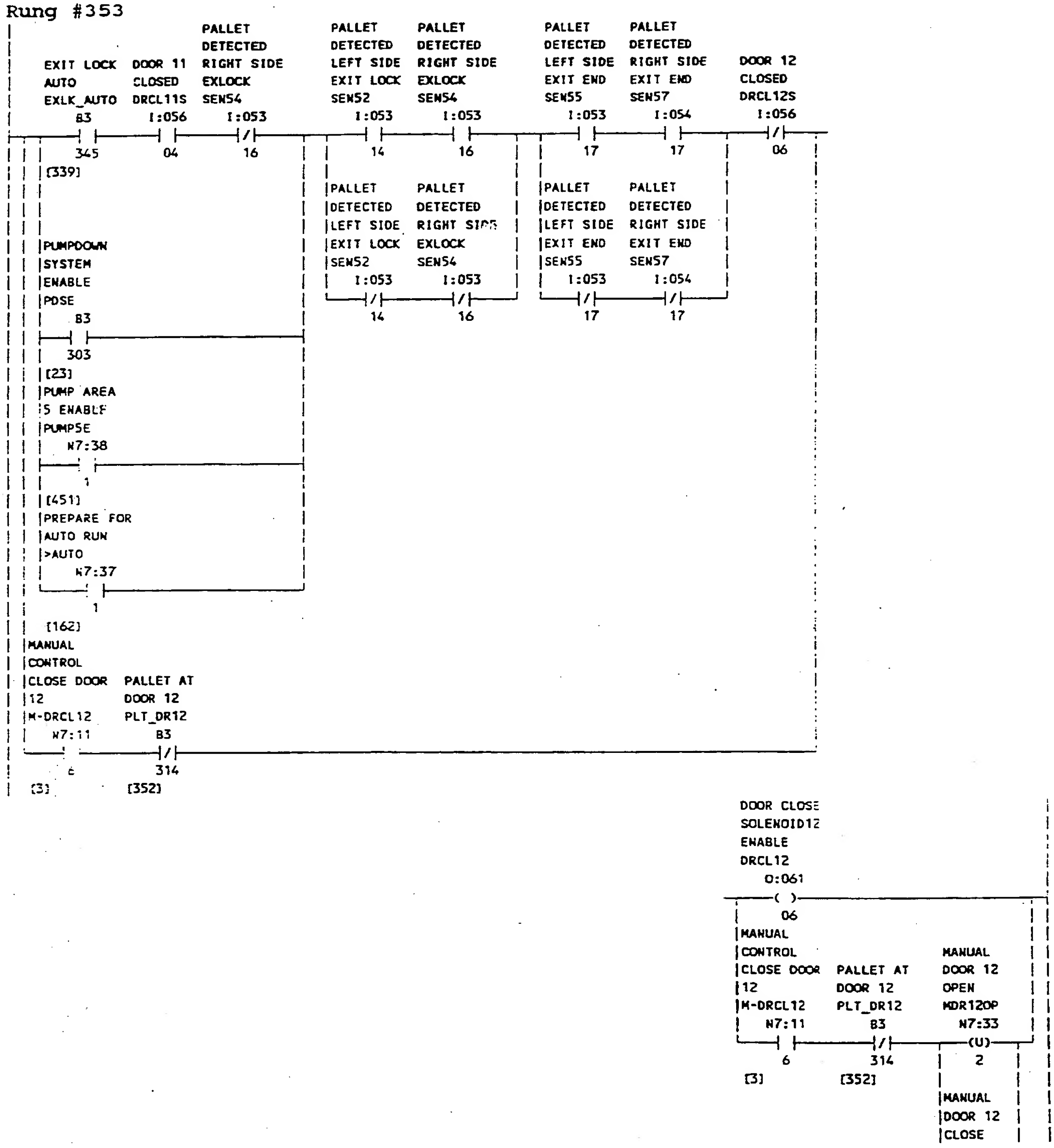
Rung #351




```
O:061/07 - -| |- - File #5 FAULTS -  63
           -( )- - File #2 MAIN_PRGRM -  351
N7:33/2 - -(L)- - File #2 MAIN_PRGRM -  351
          -(U)- - File #2 MAIN_PRGRM -  353
_F:N7:211%21 - BTW - File #2 MAIN_PRGRM -  2
N7:32/6 - -(L)- - File #2 MAIN_PRGRM -  353
          -(U)- - File #2 MAIN_PRGRM -  351
_F:N7:211%21 - BTW - File #2 MAIN_PRGRM -  2
```

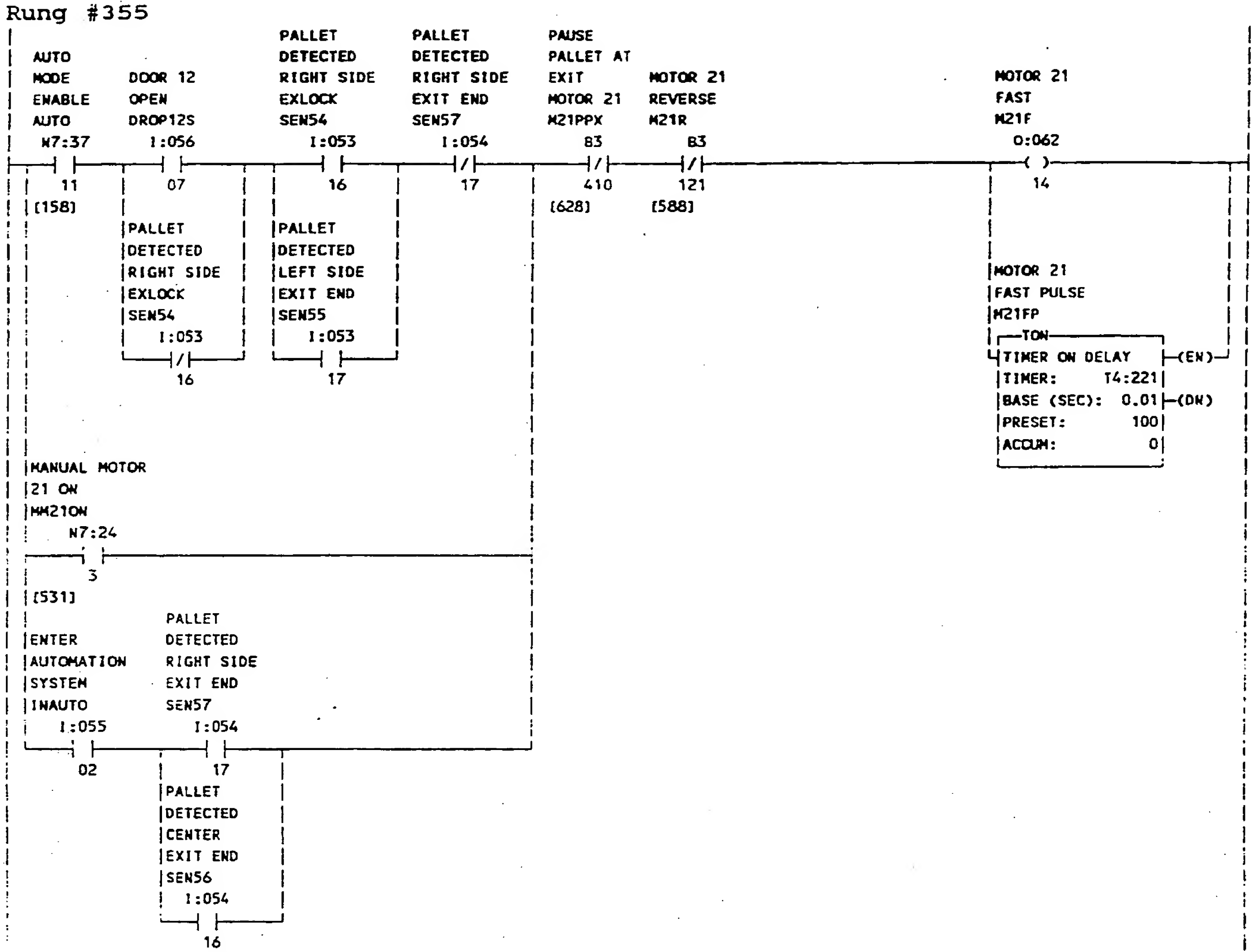
```
Rung #352
| PALLET       PALLET      PALLET                                                              |
| DETECTED     DETECTED    DETECTED                                                            |
| CENTER       RIGHT SIDE  LEFT SIDE                                               PALLET AT   |
| EXIT LOCK    EXLOCK      EXIT END                                                DOOR 12     |
| SEN53        SEN54       SEN55                                                   PLT_DR12    |
|    I:053        I:053       I:053                                                    B3      |
|-+----] [----+----] [---------] [---------------------------------------------------( )-----|
| |     15    |     16          17                                                    314      |
| |PALLET     | B3/314 - -]/[- - File #2 MAIN_PRGRM - 353                                      |
| |DETECTED   |                                                                                |
| |CENTER     |                                                                                |
| |EXIT END   |                                                                                |
| |SEN56      |                                                                                |
| |  I:054    |                                                                                |
| +----] [----+                                                                                |
|       16                                                                                     |
```

Rung #353


EXIT LOCK AUTO EXLK_AUTO B3 345 [339]
DOOR 11 CLOSED DRCL11S I:056 04
PALLET DETECTED RIGHT SIDE EXLOCK SEN54 I:053 16
PALLET DETECTED LEFT SIDE EXIT LOCK SEN52 I:053 14
PALLET DETECTED RIGHT SIDE EXLOCK SEN54 I:053 16
PALLET DETECTED LEFT SIDE EXIT END SEN55 I:053 17
PALLET DETECTED RIGHT SIDE EXIT END SEN57 I:054 17
DOOR 12 CLOSED DRCL12S I:056 06
PALLET DETECTED LEFT SIDE EXIT LOCK SEN52 I:053 14
PALLET DETECTED RIGHT SIDE SEN54 I:053 16
PALLET DETECTED LEFT SIDE EXIT END SEN55 I:053 17
PALLET DETECTED RIGHT SIDE EXIT END SEN57 I:054 17
PUMPDOWN SYSTEM ENABLE PDSE B3 303 [23]
PUMP AREA 5 ENABLE PUMP5E N7:38 1 [451]
PREPARE FOR AUTO RUN >AUTO N7:37 1 [162]
MANUAL CONTROL CLOSE DOOR 12 M-DRCL12 N7:11 6 [3]
PALLET AT DOOR 12 PLT_DR12 B3 314 [352]
DOOR CLOSE SOLENOID12 ENABLE DRCL12 O:061 06
MANUAL CONTROL CLOSE DOOR 12 M-DRCL12 N7:11 6 [3]
PALLET AT DOOR 12 PLT_DR12 B3 314 [352]
MANUAL DOOR 12 OPEN MDR12OP N7:33 2
MANUAL DOOR 12 CLOSE

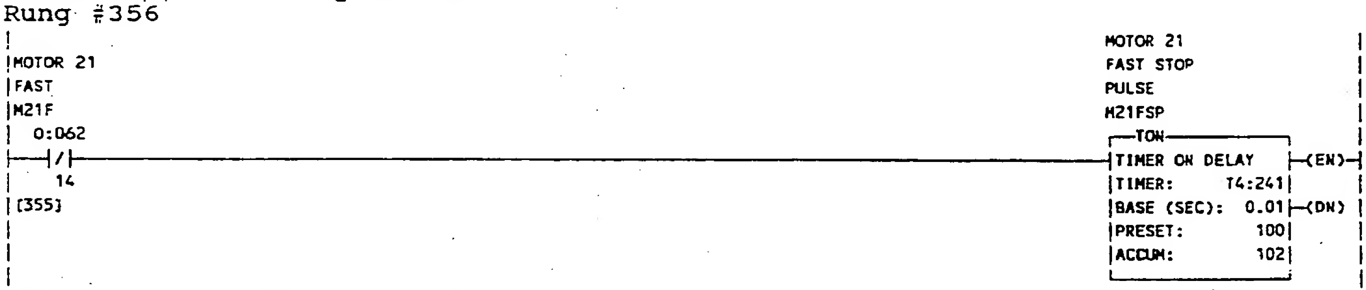
```
                                                                        <       <   <
                                                                        |MDR12CL |  |
                                                                        |  N7:32 |  |
                                                                        +---(L)--+  |
                                                                             6      |
O:061/06 - -| |- - File #5 FAULTS -  39
                   File #6 TECH_RUNGS -  3
          -( )- - File #2 MAIN_PRGRM -  353
N7:33/2 - -(L)- - File #2 MAIN_PRGRM -  351
          -(U)- - File #2 MAIN_PRGRM -  353
_F:N7:211X21 - BTW - File #2 MAIN_PRGRM -  2
N7:32/6 - -(L)- - File #2 MAIN_PRGRM -  353
          -(U)- - File #2 MAIN_PRGRM -  351
_F:N7:211X21 - BTW - File #2 MAIN_PRGRM -  2
Rung #354
|          MOTOR DRIVE                                                  MOTOR 21    |
|          PULSER                                                       INTERRUPT   |
|  M21FP   MDP                                                          M21I        |
|  T4:221       B3                                                         O:062    |
|--+-| |--+-----| |-------------------------------------------------------( )-----|
|  |  TT  |     299                                                         04      |
|  |[355] |  [14]                                                                   |
|  |M21FSP|                                                                         |
|  | T4:241|                                                                        |
|  |-| |--|                                                                         |
|  |  TT  |                                                                         |
|  |[356] |                                                                         |
|  |M21SP |                                                                         |
|  |T4:261|                                                                         |
|  |-| |--|                                                                         |
|  |  TT  |                                                                         |
|  |[357] |                                                                         |
|  |M21SSP|                                                                         |
|  | T4:281|                                                                        |
|  +-| |--+                                                                         |
|     TT                                                                           |
|  [358]                                                                           |
```

Rung #355



O:062/14 - ┤ ├ - File #5 FAULTS - 14
┤/├ - File #2 MAIN_PRGRM - 356
–( )– - File #2 MAIN_PRGRM - 355
T4:221.TT - ┤ ├ - File #2 MAIN_PRGRM - 354

Rung #356



T4:241.TT - ┤ ├ - File #2 MAIN_PRGRM - 354

Rung #357

MANUAL MOTOR
21 ON
MM21ON
N7:24
3
[531]

PAUSE
PALLET AT
EXIT
MOTOR 21
M21PPX
B3
410
[628]
0:063/04 - -|/|- - File #2 MAIN_PRGRM - 358
T4:261.TT - -| |- - File #2 MAIN_PRGRM - 354

MOTOR 21
SLOW
M21S
0:063
( )
04

MOTOR 21
SLOW PULSE
M21SP

TON
TIMER ON DELAY (EN)
TIMER: T4:261
BASE (SEC): 0.01 (DN)
PRESET: 100
ACCUM: 0

ENTER
AUTOMATION
SYSTEM
INAUTO
I:055
02

PALLET
DETECTED
RIGHT SIDE
EXIT END
SEN57
I:054
17

PALLET
DETECTED
CENTER
EXIT END
SEN56
I:054
16

MOTOR 21
REVERSE
M21R
B3
121
[588]

DOOR 12
OPEN
DROP12S
I:056
07

PALLET
DETECTED
LEFT SIDE
EXIT END
SEN55
I:053
17

Rung #358

MOTOR 21
SLOW
M21S
0:063
04
[357]

MOTOR 21
SLOW STOP
PULSE
M21SSP

TON
TIMER ON DELAY (EN)
TIMER: T4:281
BASE (SEC): 0.01 (DN)
PRESET: 100
ACCUM: 101

T4:281.TT - -| |- - File #2 MAIN_PRGRM - 354

```
Rung #359
THE PALLET COUNTER
|            PALLET                                                                        |
|PALLET IN   DETECTED                                                              PALLET  |
|CENTER      RIGHT SIDE                                                            COUNTER |
|EXBUFFER    EXBUFFER                                                              LATCH   |
|SEN50       SEN51                                                                 PALCNT  |
|   I:053       I:053                                                                B3    |
|----] [---------]/[-----------------------------------------------------------------(L)---|
|     12         13                                                                 100    |
B3/100 - ] [ - File #2 MAIN_PRGRM -  361,363,364
        -(L)- - File #2 MAIN_PRGRM -  359
        -(U)- - File #2 MAIN_PRGRM -  360
Rung #360
THE PALLET COUNTER
|PALLET                                                                                    |
|DETECTED                                                                          PALLET  |
|RIGHT SIDE                                                                        COUNTER |
|EXBUFFER                                                                          LATCH   |
|SEN51                                                                             PALCNT  |
|   I:053                                                                            B3    |
|----] [-----------------------------------------------------------------------------(U)---|
|     13                                                                            100    |
B3/100 - ] [ - File #2 MAIN_PRGRM -  361,363,364
        -(L)- - File #2 MAIN_PRGRM -  359
        -(U)- - File #2 MAIN_PRGRM -  360
Rung #361
|PALLET                                                                                    |
|COUNTER                                                              PALLET               |
|LATCH                                                                COUNTER              |
|PALCNT                                                               PCOUNT               |
|   B3                                                                +--CTU---------+     |
|----] [--------------------------------------------------------------+COUNT UP      +-(CU)-|
|   100                                                               |COUNTER:  C5:16|    |
|[360]                                                                |PRESET:   10000+-(DN)|
|                                                                     |ACCUM:       90|    |
|                                                                     +---------------+    |
C5:16 - CTU - File #2 MAIN_PRGRM -  361
        RES - File #2 MAIN_PRGRM -  362
Rung #362
|INCREMENTAL                                                                               |
|PALLET COUNTER                                                                    PALLET  |
|RESET                                                                             COUNTER |
|INC_CNT-RST                                                                       PCOUNT  |
|        B3                                                                        C5:16   |
|--------] [-------------------------------------------------------------------------[RES]--|
|        526                                                                               |
C5:16 - CTU - File #2 MAIN_PRGRM -  361
        RES - File #2 MAIN_PRGRM -  362
Rung #363
|PALLET                                                               NON-RESETABLE        |
|COUNTER                                                              PALLET COUNTER       |
|LATCH                                                                A                    |
|PALCNT                                                               NRSTCNTR_A           |
|   B3                                                                +--CTU---------+     |
|----] [--------------------------------------------------------------+COUNT UP      +-(CU)-|
|   100                                                               |COUNTER:  C5:17|    |
|[360]                                                                |PRESET:    1000+-(DN)|
|                                                                     |ACCUM:      889|    |
|                                                                     +---------------+    |
C5:17 - CTU - File #2 MAIN_PRGRM -  363
        RES - File #2 MAIN_PRGRM -  365
```

```
C5:17.DN - -| |- - File #2 MAIN_PRGRM    364,365
Rung #364
|PALLET                                                              NON-RESETABLE       |
|COUNTER                                                             PALLET COUNTER      |
|LATCH                                                               B                   |
|PALCNT   NRSTCNTR_A                                                 NRSTCNTR_B          |
|  B3       C5:17                                                    +-CTU-------+       |
|--| |------| |------------------------------------------------------|COUNT UP   |-(CU)-|
|  100       DN                                                      |COUNTER: C5:18|     |
|[360]    [363]                                                      |PRESET:  1000|-(DN)|
|                                                                    |ACCUM:     53|     |
|                                                                    +-------------+     |
Rung #365
|                                                                        NON-RESETABLE   |
|                                                                        PALLET COUNTER  |
|                                                                        A               |
|NRSTCNTR_A                                                              NRSTCNTR_A      |
|  C5:17                                                                     C5:17       |
|----| |---------------------------------------------------------------------[RES]-------|
|     DN                                                                                 |
|[365]                                                                                   |
C5:17 - CTU - File #2 MAIN_PRGRM -  363
        RES - File #2 MAIN_PRGRM -  365
C5:17.DN - -| |- - File #2 MAIN_PRGRM -  364
Rung #366
|EXLOCK                                                                                  |
|CHAMBER                                                                                 |
|PRESSUR AT                                                          CHAMBER VENT 5      |
|ATMOSPHERE                                                          CLOSE DELAY         |
|PS6                                                                 CV5_DLY             |
|  I:052                                                             +-TON------------+  |
|----| |-------------------------------------------------------------|TIMER ON DELAY  |-(EN)-|
|     04                                                             |TIMER:    T4:329|  |
|                                                                    |BASE (SEC):  1.0|-(DN)|
| T4:329.DN - -| |- - File #2 MAIN_PRGRM - 367                       |PRESET:        1|  |
|                                                                    |ACCUM:         0|  |
|                                                                    +----------------+  |
```

Rung #367

```
|                                                                                                  OPEN         |
|                                                                                                  EXLOCK       |
|                                                                                                  CHAMBER      |
|                                                                                                  VENT VALVE   |
| CVS_DLY                                                                                          CVS          |
|  T4:329                                                                                            O:057      |
|----] [------------------------------------------------------------------------------------------------(U)-----|
| |   DN                                  |                                                              16     |
| |[366]                                  |                                                                     |
| |                                       | O:057/16 - ] [ - File #2 MAIN_PRGRM - 347                           |
| |MANUAL                                 |                File #6 TECH_RUNGS - 0                               |
| |CONTROL                                |          ]/[ - File #2 MAIN_PRGRM - 67, 327, 340, 368, 453, 689, 695|
| |CHAMBER                                |          (L)- - File #2 MAIN_PRGRM - 346                            |
| |VENT VALVE                             |                                                                     |
| |5 CLOSE                                |                                                                     |
| |M-CVS-O                                |                                                                     |
| |     N7:4                              |                                                                     |
| |-----] [-------------------------------|                                                                     |
| |      4                                |                                                                     |
| |[3]                                    |                                                                     |
| |           EXITLOCK                    |                                                                     |
| |           CHAMBER                     |                                                                     |
| |DOOR 11    GATE VALVE                  |                                                                     |
| |CLOSED     CLOSED                      |                                                                     |
| |DRCL11S    HV12S1                      |                                                                     |
| |  I:056       I:054                    |                                                                     |
| |----]/[--------]/[---------------------|                                                                     |
| |    04         03                      |                                                                     |
| |                       BUFFER 4        |                                                                     |
| |                       CHAMBER         |                                                                     |
| |DOOR 11    DOOR 10     GATE VALVE      |                                                                     |
| |OPEN       OPEN        CLOSED          |                                                                     |
| |DROP11S    DROP10S     HV11S1          |                                                                     |
| |  I:056     I:056         I:054        |                                                                     |
| |----] [------] [-------+----]/[-----+--|                                                                     |
| |    05         03      |     00     |  |                                                                     |
| |                       |DWELL 6     |  |                                                                     |
| |                       |CHAMBER     |  |                                                                     |
| |                       |GATE VALVE  |  |                                                                     |
| |                       |CLOSED      |  |                                                                     |
| |                       |HV10S1      |  |                                                                     |
| |                       |    I:052   |  |                                                                     |
| |                       |----]/[-----|  |                                                                     |
| |                       |     06     |  |                                                                     |
| |                       |DWELL 5     |  |                                                                     |
| |                       |CHAMBER     |  |                                                                     |
| |                       |GATE VALVE  |  |                                                                     |
| |                       |CLOSED      |  |                                                                     |
| |                       |HV9S1       |  |                                                                     |
| |                       |    I:040   |  |                                                                     |
| |                       +----]/[-----+  |                                                                     |
| |                             03        |                                                                     |
| |                          EXLOCK       |                                                                     |
| |PUMPDOWN                  CHAMBER      |                                                                     |
| |EXIT LOCK     DOOR 11     PRESSUR AT   |                                                                     |
| |CLEAN CYCLE   CLOSED      ATMOSPHERE   |                                                                     |
| |PD-EX-CC      DRCL11S     PS6          |                                                                     |
| |     B3          I:056      I:052      |                                                                     |
| |-----] [----------] [--------] [-------|                                                                     |
| |     497          04         04        |                                                                     |
| |[692]                                  |                                                                     |
| |             EXLOCK                    |                                                                     |
> >                                       >                                                                     >
```

```
< <                                                                    <
| |            CHAMBER          |                                      |
| |VENT        PRESSUR AT       |                                      |
| |EXIT LOCK   ATMOSPHERE       |                                      |
| |VNT-EX      PS6              |                                      |
| |   B3          I:052         |                                      |
| |---] [--------] [------------|                                      |
| |   498          04           |                                      |
| |[694]                        |                                      |
| |ABORT SYSTEM                 |                                      |
| |VENT                         |                                      |
| |BORT_SYS_VNT                 |                                      |
| |    N7:17                    |                                      |
| |----] [----------------------|                                      |
|        10                                                            |
| [3]                                                                  |
Rung #368
| ALL        OPEN                                      OPEN                               |
| CHAMBERS   LOAD LOCK   OPEN        OPEN        OPEN        EXLOCK                SYSTEM |
| AT         CHAMBER     DWELL 2     DWELL 3     DWELL 5     CHAMBER               VENT   |
| ATMOSPHERE VENT VALVE  VENT VALVE  VENT VALVE  VENT VALVE  VENT VALVE            ENABLE |
| CH@ATMOS   CV1         CV2         CV3         CV4         CV5                   SYSVNTE|
|     B3        0:007       0:007       0:027       0:043       0:057              N7:37 |
|-+---] [-------]/[---------]/[---------]/[---------]/[---------]/[--+-------------(U)----|
| |  383          16          17          16          16          16 |               5    |
| |[404]       [177]       [396]       [401]       [403]       [367] |                    |
| |                                                                  | N7:37/5 - ] [ - - File #2 MAIN_PRGRM - 34, 35, 36,
| |                                                                  |         37, 43, 46, 47, 48, 49, 110,
| |                                                                  |         111, 112, 113, 114, 200, 216,
| |                                                                  |         324, 326, 327, 370, 391
| |ABORT SYSTEM                                                      |     ]/[ - File #2 MAIN_PRGRM - 23, 115,
| |VENT                                                              |         117, 118, 119, 120, 121, 122,
| |BORT_SYS_VNT                                                      |         123, 124, 125, 126, 127, 128,
| |    N7:17                                                         |         129, 130, 131, 132, 133, 134,
| |----] [-----------------------------------------------------------|         135, 136, 137, 138, 375, 376,
| |     10                                                           |         377, 378, 434, 438, 442, 447,
| |[3]                                                               |         451
| |                                                                  |     -(L)- - File #2 MAIN_PRGRM - 369
| |                                                                  | _F:N7:21(X21 - BTW - File #2 MAIN_PRGRM - 2
| |PREPARE FOR                                                       |
| |AUTO RUN                                                          |
| |>AUTO                                                             |
| |    N7:37                                                         |
| |----] [-----------------------------------------------------------|
|        1
| [162]
Rung #369
|        PUMPDOWN                                                      AUTO                  SYSTEM |
|SYSTEM  SYSTEM    PUMP AREA  PUMP AREA  PUMP AREA  PUMP AREA  PUMP AREA  MODE                 VENT   |
|VENT    ENABLE    1 ENABLE   2 ENABLE   3 ENABLE   4 ENABLE   5 ENABLE   ENABLE               ENABLE |
|TS13    POSE      PUMP1E     PUMP2E     PUMP3E     PUMP4E     PUMP5E     AUTO                 SYSVNTE|
| N7:16    B3        N7:37      N7:37      N7:37      N7:38      N7:38      N7:37               N7:37 |
|--] [-----]/[--------]/[--------]/[--------]/[--------]/[--------]/[--------]/[----------------(L)---|
|  5      303         13         14         15          0          1         11                  5    |
|[3]     [23]       [434]      [438]      [442]      [447]      [451]      [158]                      |
N7:37/5 - ] [ - - File #2 MAIN_PRGRM - 34,35,36,37,43,46,47,48,49,110,111,112,113,114,200,216,324,326,327,370,391
          ]/[ - - File #2 MAIN_PRGRM - 23,115,117,118,119,120,121,122,123,124,125,126,127,128,129,130,131,132,133,134,135,136,137
                  138,375,376,377,378,434,438,442,447,451
          -(L)- - File #2 MAIN_PRGRM - 369
          -(U)- - File #2 MAIN_PRGRM - 368
_F:N7:21(X21 - BTW - File #2 MAIN_PRGRM - 2
```

```
Rung #370
|                                                                      SYSTEM              |
|SYSTEM                                                                VENT                |
|VENT                                                                  ENABLE              |
|ENABLE                                                                PULSE               |
|SYSVNTE                                                               SYSVNTPLSE          |
|  N7:37                                                               +-TON-----------+   |
|--] [---------------------------------------------------------------+-|TIMER ON DELAY |-(EN)-|
|   5                                                                  |TIMER:   T4:286|   |
|[369]                                                                 |BASE (SEC):  1.0|-(DN) |
|                                                                      |PRESET:     180|   |
|                                                                      |ACCUM:        0|   |
|                                                                      +---------------+   |
T4:286 - TON - File #2 MAIN_PRGRM -  370
         LEQ - File #2 MAIN_PRGRM -  84,91,98
T4:286.DN - ] [ - File #2 MAIN_PRGRM -  608
Rung #371
|MANUAL     HEATER 1                                                                       |
|CONTROL    CHAMBER                                                       OPEN RGA         |
|RGA VALVE  =<250                                                         ISOLATION        |
|1 OPEN     MICRONS                                                       VALVE 1          |
|M-RGAV1-1  PIR2                                                          RGAV1            |
|  N7:7       I:004                                                         O:010          |
|--] [--------] [-----------------------------------------------------+-----(L)-----+------|
|   5          10                                                     |      13     |      |
|[3]                                                                  |             |      |
| O:010/13 - ] [ - File #6 TECH_RUNGS - 7                             |MANUAL RGA   |      |
|           -(U)- - File #2 MAIN_PRGRM - 34                           |VALVE 1      |      |
| N7:28/5 - -(U)- - File #2 MAIN_PRGRM - 34                           |OPEN         |      |
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                         |MRGAV1OP     |      |
| N7:30/1 - -(L)- - File #2 MAIN_PRGRM - 34                           |  N7:28      |      |
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                         +-----(L)-----+      |
|                                                                     |      5      |      |
|                                                                     |MANUAL RGA   |      |
|                                                                     |VALVE 1      |      |
|                                                                     |CLOSE        |      |
|                                                                     |MRGAV1CL     |      |
|                                                                     |  N7:30      |      |
|                                                                     +-----(U)-----+      |
|                                                                            1             |
Rung #372
|MANUAL     CHROME                                                                         |
|CONTROL    CHAMBER                                                     OPEN RGA           |
|RGA VALVE  =<250                                                       ISOLATION          |
|2 OPEN     MICRONS                                                     VALVE 2            |
|M-RGAV2-1  PIR6                                                        RGAV2              |
|  N7:7       I:024                                                       O:030            |
|--] [--------] [---------------------------------------------------+-----(L)-----+--------|
|   6          07                                                   |      13     |        |
|[3]                                                                |             |        |
| O:030/13 - ] [ - File #6 TECH_RUNGS - 7                           |MANUAL RGA   |        |
|           -(U)- - File #2 MAIN_PRGRM - 35                         |VALVE 2      |        |
| N7:28/6 - -(U)- - File #2 MAIN_PRGRM - 35                         |OPEN         |        |
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                       |MRGAV2OP     |        |
| N7:30/2 - -(L)- - File #2 MAIN_PRGRM - 35                         |  N7:28      |        |
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                       +-----(L)-----+        |
|                                                                   |      6      |        |
|                                                                   |MANUAL RGA   |        |
|                                                                   |VALVE 2 CLOSE|        |
|                                                                   |MRGAV2CL     |        |
|                                                                   |  N7:30      |        |
|                                                                   +-----(U)-----+        |
|                                                                          2               |
```

```
Rung #373
|MANUAL      MAGNETIC
|CONTROL     CHAMBER                                              OPEN RGA
|RGA VALVE   =<250                                                ISOLATION
|3 OPEN      MICRONS                                              VALVE 3
|M-RGAV3-1   PIR11                                                RGAV3
|  N7:7       I:040                                                 O:044
|---| |--------| |--------------------------------------------------+--(L)--+--|
|    7          07                                                  |   13   |
|[3]                                                                |        |
| O:044/13 - -| |- - File #6 TECH_RUNGS - 7                        |MANUAL RGA
|            -(U)- - File #2 MAIN_PRGRM - 36                       |VALVE 3
| N7:28/7 - -(U)- - File #2 MAIN_PRGRM - 36                        |OPEN
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                      |MRGAV3OP
| N7:30/3 - -(L)- - File #2 MAIN_PRGRM - 36                        |  N7:28
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                      +--(L)---+
|                                                                   |   7    |
|                                                                   |MANUAL RGA
|                                                                   |VALVE 3 CLOSE
|                                                                   |MRGAV3CL
|                                                                   |   N7:30
|                                                                   +---(U)--+
|                                                                        3
Rung #374
|MANUAL      EXIT BUFFER
|CONTROL     CHAMBER                                              OPEN RGA
|RGA VALVE   =<250                                                ISOLATION
|4 OPEN      MICRONS                                              VALVE 4
|M-RGAV4-1   PIR15                                                RGAV4
|  N7:7       I:040                                                 O:060
|---| |--------| |--------------------------------------------------+--(L)--+--|
|    8          13                                                  |   13   |
|[3]                                                                |        |
| O:060/13 - -| |- - File #6 TECH_RUNGS - 7                        |MANUAL RGA
|            -(U)- - File #2 MAIN_PRGRM - 37                       |VALVE 4
| N7:28/8 - -(U)- - File #2 MAIN_PRGRM - 37                        |OPEN
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                      |MRGAV4OP
| N7:30/4 - -(L)- - File #2 MAIN_PRGRM - 37                        |  N7:28
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                      +--(L)---+
|                                                                   |   8    |
|                                                                   |MANUAL RGA
|                                                                   |VALVE 4 CLOSE
|                                                                   |MRGAV4CL
|                                                                   |   N7:30
|                                                                   +---(U)--+
|                                                                        4
Rung #375
|                                                                     OPEN
|HEATER 1                                                             CAPACITANC
|CHAMBER                  SYSTEM                                      MANOMETER
|=<250       VENT AREA    VENT                                        ISOLATION
|MICRONS     1 ENABLE     ENABLE                                      VALVE 1
|PIR2        VENT1E       SYSVNTE                                     CMV1
| I:004       N7:37        N7:37                                        O:010
|---| |--------|/|----------|/|-------------------------------------------( )---|
|    10          6            5                                          06
|              [405]        [369]
O:010/06 - -| |- - File #6 TECH_RUNGS -  7
           -|/|- - File #2 MAIN_PRGRM -  389,409
           -( )- - File #2 MAIN_PRGRM -  375
```

```
Rung #376
|                                                                    OPEN          |
|CHROME                                                              CAPACITANC    |
|CHAMBER                     SYSTEM                                  MANOMETER     |
|=<250      VENT AREA  VENT                                          ISOLATION     |
|MICRONS    2 ENABLE   ENABLE                                        VALVE 2       |
|PIR6       VENT2E     SYSVNTE                                       CMV2          |
|  I:024      N7:37      N7:37                                         O:030       |
|---| |--------|/|--------|/|------------------------------------------( )--------|
|   07         7          5                                             06         |
|            [411]       [369]                                                     |
O:030/06 - -| |- - File #6 TECH_RUNGS -  7
           -|/|- - File #2 MAIN_PRGRM -  389,416
           -( )- - File #2 MAIN_PRGRM -  376
Rung #377
|                                                                    OPEN          |
|MAGNETIC                                                            CAPACITANC    |
|CHAMBER                     SYSTEM                                  MANOMETER     |
|=<250      VENT AREA  VENT                                          ISOLATION     |
|MICRONS    3 ENABLE   ENABLE                                        VALVE 3       |
|PIR11      VENT3E     SYSVNTE                                       CMV3          |
|  I:040      N7:37      N7:37                                         O:044       |
|---| |--------|/|--------|/|------------------------------------------( )--------|
|   07         8          5                                             06         |
|            [418]       [369]                                                     |
O:044/06 - -| |- - File #6 TECH_RUNGS -  7
           -|/|- - File #2 MAIN_PRGRM -  389,423
           -( )- - File #2 MAIN_PRGRM -  377
Rung #378
|                                                                    OPEN          |
|CARBON                                                              CAPACITANC    |
|CHAMBER                     SYSTEM                                  MANOMETER     |
|=<250      VENT AREA  VENT                                          ISOLATION     |
|MICRONS    4 ENABLE   ENABLE                                        VALVE 4       |
|PIR16      VENT4E     SYSVNTE                                       CMV4          |
|  I:054      N7:37      N7:37                                         O:060       |
|---| |--------|/|--------|/|------------------------------------------( )--------|
|   07         9          5                                             06         |
|            [425]       [369]                                                     |
O:060/06 - -| |- - File #6 TECH_RUNGS -  7
           -|/|- - File #2 MAIN_PRGRM -  389,428
           -( )- - File #2 MAIN_PRGRM -  378
```

BASE : Rung #379

```
| MANUAL                                                                         |
| CONTROL                                                              OPEN      |
| GAS FLOW                                                             GAS FLOW  |
| VALVE 1                                                              ISOLATION |
| OPEN                                                                 VALVE 1   |
| M-GF1-1                                                              GF1       |
|   N7:9                                                                 O:010   |
|---] [---+-----------------------------------------------------------+---(L)---+-|
| |  15   |                                                           |    07   | |
| |[3]    |                                                           |         | |
| |       | O:010/07 - -(U)- - File #2 MAIN_PRGRM - 38                |         | |
| |       | N7:30/15 - -(U)- - File #2 MAIN_PRGRM - 38                |MANUAL GAS | |
| |       | _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2               |FLOW I V 1 | |
| |       | N7:30/7 - -(L)- - File #2 MAIN_PRGRM - 38                 |OPEN     | |
| |HEATER 1      GAS FLOW 1 | _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2 |MGFIV1OP | |
| |HIVAC BAFFLE  LATCH ONS  |                                         |  N7:30  | |
| |HV1_2         GF1ONS     |                                         +---(L)---+ |
| |  O:011         B3       |                                         |    15   | |
| +---] [-------[ONS]-------+                                         |         | |
|     12         177                                                  |         | |
| [215]                                                               |MANUAL GAS | |
|                                                                     |FLOW I V 1 | |
|                                                                     |CLOSE    | |
|                                                                     |MGFIV1CL | |
|                                                                     |  N7:30  | |
|                                                                     +---(U)---+ |
|                                                                          7        |
```

12

```
Rung #380
|                                                                   OPEN
|MANUAL CONTROL                                                     GAS FLOW
|GAS FLOW VALVE                                                     ISOLATION
|2 OPEN                                                             VALVE 2
|G-GF2-1                                                            GF2
|      N7:10                                                           O:010
|------| |-----------------------------------------------------------+---(L)---+-
|       0                                                            |   10    |
|[3]                                                                 |         |
| O:010/10 - -(U)- - File #2 MAIN_PRGRM - 39                         |MANUAL GAS|
| N7:31/0 - -(U)- - File #2 MAIN_PRGRM - 39                          |FLOW I V 2|
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                        |OPEN     |
| N7:30/8 - -(L)- - File #2 MAIN_PRGRM - 39                          |MGFIV2OP |
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                        |  N7:31  |
|                                                                    +---(L)---+
|                                                                    |   0     |
|                                                                    |MANUAL GAS|
|                                                                    |FLOW I V 2|
|                                                                    |CLOSE    |
|                                                                    |MGFIV2CL |
|                                                                    |  N7:30  |
|                                                                    +---(U)---+
|                                                                        8
```

BASE : Rung #381

```
MANUAL CONTROL                                              OPEN
GAS FLOW VALVE                                              GAS FLOW
3 OPEN                                                      ISOLATION
M-GF3-1                                                     VALVE 3
    N7:10                                                   GF3
                                                              O:030
---] [---------------------------------------------------------(L)---
     1                                                         07
[3]
             O:030/07 - ] [ - File #2 MAIN_PRGRM - 156         MANUAL GAS
                       -(U)- - File #2 MAIN_PRGRM - 40         FLOW I V 3
             N7:31/1 - -(U)- - File #2 MAIN_PRGRM - 40         OPEN
             _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2       MGFIV3OP
PREPARE FOR  GAS FLOW 3                                          N7:31
AUTO RUN     LATCH ONS  N7:30/9 - -(L)- - File #2 MAIN_PRGRM - 40  ---(L)---
>AUTO        GF3ONS     _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2   1
   N7:37        63
---] [-------[ONS]---                                          MANUAL GAS
    1          178                                             FLOW I V 3
[162]                                                          CLOSE
                                                               MGFIV3CL
                                                                 N7:30
                                                               ---(U)---
                                                                   9
```

Rung #382

```
MANUAL
CONTROL
GAS FLOW                                                    OPEN
VALVE 4                                                     GAS FLOW
OPEN                                                        ISOLATION
M-GF4-1                                                     VALVE 4
  N7:10                                                     GF4
                                                              O:030
---] [---------------------------------------------------------(L)---
    2                                                           10
[3]
O:030/10 - -(U)- - File #2 MAIN_PRGRM - 41                     MANUAL GAS
N7:31/2 - -(U)- - File #2 MAIN_PRGRM - 41                      FLOW I V 4
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                    OPEN
N7:30/10 - -(L)- - File #2 MAIN_PRGRM - 41                     MGFIV4OP
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                      N7:31
                                                               ---(L)---
                                                                   2
                                                               MANUAL GAS
                                                               FLOW I V 4
                                                               CLOSE
                                                               MGFIV4CL
                                                                 N7:30
                                                               ---(U)---
                                                                   10
```

```
BASE :   Rung #383
| MANUAL                                                                    |
| CONTROL                                                                   |
| GAS FLOW                                                        GAS FLOW  |
| VALVE 5                                                         ISOLATION |
| OPEN                                                            VALVE 5   |
| M-GF5-1                                                         GF5       |
|  N7:10                                                            O:044   |
|-+--] [--+-------------------------------------------------------+---(L)---+-|
| |   3   |                                                       |    07   | |
| |[3]    |                                                       |         | |
| |       | O:044/07 - -] [- - File #2 MAIN_PRGRM - i56           |         | |
| |       |          -(U)- - File #2 MAIN_PRGRM - 42              |MANUAL GAS | |
| |       | N7:31/3 - -(U)- - File #2 MAIN_PRGRM - 42             |FLOW I V 5 | |
| |       | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2           |OPEN     | |
| |PREPARE FOR  GAS FLOW 5 | N7:30/11 - -(L)- - File #2 MAIN_PRGRM - 42 |MGFIV5OP | |
| |AUTO RUN     LATCH ONS  | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2 | N7:31 | |
| |>AUTO        GF5ONS  |                                         +---(L)---+ |
| |  N7:37        B3    |                                         |    3    | |
| +---] [------[ONS]----+                                         |         | |
|      1         179                                              |MANUAL GAS | |
| [162]                                                           |FLOW I V 5 | |
|                                                                 |CLOSE    | |
|                                                                 |MGFIV5CL | |
|                                                                 |  N7:30  | |
|                                                                 +---(U)---+ |
|                                                                     11      |

   #384
|MANUAL
|CONTROL
|GAS FLOW                                                         GAS FLOW  |
|VALVE 6                                                          ISOLATION |
|OPEN                                                             VALVE 6   |
|M-GF6-1                                                          GF6       |
|  N7:10                                                            O:044   |
|---] [-----------------------------------------------------------+---(L)---+-|
|    4                                                            |    10   | |
|[3]                                                              |         | |
| O:044/10 - -(U)- - File #2 MAIN_PRGRM - 43                      |MANUAL GAS | |
| N7:31/4 - -(U)- - File #2 MAIN_PRGRM - 43                       |FLOW I V 6 | |
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                     |OPEN     | |
| N7:30/12 - -(L)- - File #2 MAIN_PRGRM - 43                      |MGFIV6OP | |
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                     |  N7:31  | |
|                                                                 +---(L)---+ |
|                                                                 |    4    | |
|                                                                 |MANUAL GAS | |
|                                                                 |FLOW I V 6 | |
|                                                                 |CLOSE    | |
|                                                                 |MGFIV6CL | |
|                                                                 |  N7:30  | |
|                                                                 +---(U)---+ |
|                                                                     12      |
```

BASE : Rung #385

```
| MANUAL                                                                                         |
| CONTROL                                                                                        |
| GAS FLOW                                                                           GAS FLOW    |
| VALVE 7                                                                            ISOLATION   |
| OPEN                                                                               VALVE 7     |
| M-GF7-1                                                                            GF7         |
|   N7:10                                                                              O:060     |
|-+---] [---------+------------------------------------------------------------------+---(L)---+-|
| |     5         |                                                                  |   07    | |
| |[3]            |                                                                  |         | |
| |               | O:060/07 - -] [- - File #2 MAIN_PRGRM - 156                      |         | |
| |               |          -(U)- - File #2 MAIN_PRGRM - 44                         |MANUAL GAS| |
| |               | N7:31/5 - -(U)- - File #2 MAIN_PRGRM - 44                        |FLOW I V 7| |
| |               | _F:N7:21L%21 - BTW - File #2 MAIN_PRGRM - 2                      |OPEN     | |
| |PREPARE FOR  GAS FLOW 7 | N7:30/13 - -(L)- - File #2 MAIN_PRGRM - 44              |MGFIV7OP | |
| |AUTO RUN     LATCH ONS  | _F:N7:21L%21 - BTW - File #2 MAIN_PRGRM - 2             |  N7:31  | |
| |>AUTO        GF7ONS     |                                                         +---(L)---+ |
| |  N7:37        B3       |                                                         |   5     | |
| +---] [--------[ONS]-----+                                                         |         | |
|      1         180                                                                 |         | |
| [162]                                                                              |MANUAL GAS| |
|                                                                                    |FLOW I V 7| |
|                                                                                    |CLOSE    | |
|                                                                                    |MGFIV7CL | |
|                                                                                    |  N7:30  | |
|                                                                                    +---(U)---+ |
|                                                                                        13      |
```

BASE : Rung #386

```
| MANUAL
| CONTROL
| GAS FLOW                                                                                GAS FLOW
| VALVE 8                                                                                 ISOLATION
| OPEN                                                                                    VALVE 8
| M-GF8-1                                                                                 GF8
|   N7:10                                                                                   O:060
|---] [------------------------------------------------------------------------------------(L)----
|    6                                                                                       10
| [3]
|                       | O:060/10 - -(U)- - File #2 MAIN_PRGRM - 45                    |MANUAL GAS
|                       | N7:31/6 - -(U)- - File #2 MAIN_PRGRM - 45                     |FLOW I V 8
|                       | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                    |OPEN
|                       | N7:30/14 - -(L)- - File #2 MAIN_PRGRM - 45                    |MGFIV8OP
| |PREPARE FOR  GAS FLOW 8 | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                 |   N7:31
| |AUTO RUN     LATCH ONS                                                               |----(L)----
| |>AUTO        GF8ONS                                                                       6
| |  N7:37         B3
| |---] [---------[ONS]---                                                               |MANUAL GAS
|      1          181                                                                    |FLOW I V 8
| [162]                                                                                  |CLOSE
|                                                                                        |MGFIV8CL
|                                                                                        |   N7:30
|                                                                                        |----(U)----
|                                                                                             14
```

Rung #387

```
|                                                                                  CRYO        |
|OPEN       OPEN        OPEN        OPEN        OPEN        OPEN                   VALVES      |
|CRYO ROUGH CRYO ROUGH  CRYO ROUGH  CRYO ROUGH  CRYO ROUGH  CRYO ROUGH             1->6        |
|VALVE 1    VALVE 2     VALVE 3     VALVE 4     VALVE 5     VALVE 6                CLOSED      |
|CR1        CR2         CR3         CR4         CR5         CR6                    CR1->6_CL   |
|  0:007      0:007       0:007       0:027       0:027       0:027                   B3       |
|---]/[-------]/[---------]/[---------]/[---------]/[---------]/[---------------------( )------|
|    11          12          13          11          12          13                   381      |
|[3:15]     [3:164]     [3:165]     [3:167]     [3:166]     [3:168]                            |
B3/381 - ] [ - File #2 MAIN_PRGRM - 391
       -( )- - File #2 MAIN_PRGRM - 387
```

Rung #388

```
|                                                                                  CRYO        |
|OPEN       OPEN        OPEN        OPEN        OPEN        OPEN                   VALVES      |
|CRYO ROUGH CRYO ROUGH  CRYO ROUGH  CRYO ROUGH  CRYO ROUGH  CRYO ROUGH             7->12       |
|VALVE 7    VALVE 8     VALVE 9     VALVE 10    VALVE 11    VALVE 12               CLOSED      |
|CR7        CR8         CR9         CR10        CR11        CR12                   CR7->12_CL  |
|  0:043      0:043       0:043       0:057       0:057       0:057                   B3       |
|---]/[-------]/[---------]/[---------]/[---------]/[---------]/[---------------------( )------|
|    11          12          13          11          12          13                   382      |
|[3:169]    [3:170]     [3:171]     [3:172]     [3:174]     [3:173]                            |
B3/382 - ] [ - File #2 MAIN_PRGRM - 391
       -( )- - File #2 MAIN_PRGRM - 388
```

Rung #389

```
|OPEN        OPEN        OPEN        OPEN                                          ALL CAP.    |
|CAPACITANC  CAPACITANC  CAPACITANC  CAPACITANC                                    MANOMETER   |
|MANOMETER   MANOMETER   MANOMETER   MANOMETER                                     ISOLATION   |
|ISOLATION   ISOLATION   ISOLATION   ISOLATION                                     VALVES      |
|VALVE 1     VALVE 2     VALVE 3     VALVE 4                                       CLOSED      |
|CMV1        CMV2        CMV3        CMV4                                          CMIV_CL     |
|  0:010       0:030       0:044       0:060                                          B3       |
|---]/[--------]/[---------]/[---------]/[----------------------------------------------( )------|
|    06          06          06          06                                           380      |
|[375]       [376]       [377]       [378]                                                     |
B3/380 - ] [ - File #2 MAIN_PRGRM - 391
       -( )- - File #2 MAIN_PRGRM - 389
```

Rung #390

```
|HEATER 1    HEATER 2    DWELL 1     DWELL 2     HEATER 3    DWELL 3     DWELL 4     BUFFER 3    DWELL 5     DWELL 6
|CHAMBER     CHAMBER     CHAMBER     CHAMBER     CHAMBER     CHAMBER     CHAMBER     CHAMBER     CHAMBER     CHAMBER
|GATE VALVE  GATE VALVE  GATE VALVE  GATE VALVE  GATE VALVE  GATE VALVE  GATE VALVE  GATE VALVE  GATE VALVE  GATE VALVE
|CLOSE       CLOSE       CLOSED      CLOSED      CLOSED      CLOSED      CLOSED      CLOSED      CLOSED      CLOSED
|HV1S1       HV2S1       HV3S1       HV4S1       HV5S1       HV6S1       HV7S1       HV8S1       HV9S1       HV10S1
|  1:002       1:004       1:004       1:022       1:024       1:024       1:036       1:040       1:040       1:052
|---] [--------] [---------] [---------] [---------] [---------] [---------] [---------] [---------] [---------] [----
|    06          00          03          06          00          03          06          00          03          06
                                                                                        BUFFER 4    EXITLOCK               |
                                                                                        CHAMBER     CHAMBER     ALL HIVAC  |
                                                                                        GATE VALVE  GATE VALVE  GATES      |
                                                                                        CLOSED      CLOSED      CLOSED     |
                                                                                        HV11S1      HV12S1      HVGC       |
                                                                                          1:054       1:054       B3       |
                                                                                     -----] [---------] [---------( )------|
                                                                                          00          03          150      |

B3/150 - ] [ - File #2 MAIN_PRGRM - 391
       -( )- - File #2 MAIN_PRGRM - 390
```

```
BASE :   Rung #391
|
|                                  ALL CAP.
|                     ALL RGA      MANOMETER  CRYO       CRYO
|SYSTEM    ROUGH      ISOLATION    ISOLATION  VALVES     VALVES       ALL HIVAC
|VENT      VALVES     VALVES       VALVES     1->6       7->12        GATES                          READY TO
|ENABLE    CLOSED     CLOSED       CLOSED     CLOSED     CLOSED       CLOSED                         VENT
|SYSVNTE   RVCL       RGACL        CMIV_CL    CR1->6_CL  CR7->12_CL   HVGC                           RTOVENT
| N7:37      B3         B3           B3         B3          B3          B3                            B3
|--] [-----] [-------] [---------] [--------] [---------] [----------] [---------------------------( )--|
|   5       310        305          380        381         382         150                           379
|[369]     [66]       [63]         [389]      [387]       [388]       [390]
B3/379 - ] [ - - File #2 MAIN_PRGRM - 392
         -( )- - File #2 MAIN_PRGRM - 391
         -( )- - File #2 MAIN_PRGRM - 391
Rung #392
|                                                                     READY TO VENT
|READY TO                                                             CHAMBER VENT
|VENT                                                                 DELAY TIMER
|RTOVENT                                                              RTVCVDT
|  B3                                                                 +-TON-------------+
|--] [----------------------------------------------------------------+TIMER ON DELAY   +-(EN)-
|  379                                                                |TIMER:       T4:0|
|[391]                                                                |BASE (SEC):   1.0+-(DN)
|                                                                     |PRESET:         5|
|                                                                     |ACCUM:          0|
|                                                                     +-----------------+
T4:0.DN - ] [ - - File #2 MAIN_PRGRM - 173,346,394,401,403
Rung #393
|VENT 2                                                               VENT 2 STAGE1
|STAGE 1                                                              DELAY TIMER
|V2ST1                                                                V2DYTMR
|  B3                                                                 +-TON-------------+
|--] [----------------------------------------------------------------+TIMER ON DELAY   +-(EN)-
|  414                                                                |TIMER:      T4:19|
|[416]                                                                |BASE (SEC):   1.0+-(DN)
|                                                                     |PRESET:         5|
|                                                                     |ACCUM:          0|
|                                                                     +-----------------+
T4:19.DN - ] [ - File #2 MAIN_PRGRM - 394
```

```
BASE :   Rung #394
|                                    DWELL 1      DWELL 2      HEATER 3
|                                    CHAMBER      CHAMBER      CHAMBER
| READY TO                           GATE VALVE   GATE VALVE   GATE VALVE
| VENT                               CLOSED       CLOSED       CLOSED       POLYCOLD COOL                              VENT 2 REQUEST
| RTVCVDT                            HV3S1        HV4S1        HV5S1        PC_COOL                                    VNT2_RQST
|    T4:0                              I:004        I:022        I:024         O:074                                       B3
|-+--] [--------------------------+------] [----------] [----------] [-----------]/[---------------------------------------( )---|
| |    DN                         |      03           06           00            11                                       164
| |[392]                          |                                         [400]
| |CHAMBER VENT                   |
| |ENABLE DELAY                   |
| |V2DYTMR                        |
| |    T4:19                      |
| |-----] [-----------------------|
| |    DN                         |
| |[393]                          |
| |MANUAL                         |
| |CONTROL     HEATER 2           |
| |CHAMBER     CHAMBER            |
| |VENT 2      GATE VALVE         |
| |OPEN        CLOSE              |
| |M-CV2-1     HV2S1              |
| |  N7:6        I:004            |
| +--] [-----+----] [-----+-------+
|     12     |      00    |
|  [3]       |            |
|            |DOOR 4      |
|            |CLOSED      |
|            |DRCL4S      |
|            | I:006      |
|            +---] [------+
|                 06
B3/164 - -] [- - File #2 MAIN_PRGRM -  395,396
         -( )- - File #2 MAIN_PRGRM -  394
```

```
BASE :   Rung #395
|                                                                        POLYCOLD |
|                  POLYCOLD                                              DEFROST  |
|VENT 2 REQUEST  SETPOINT HIGH                                           PCDEF    |
|VNT2_RQST       PCSPH                                                    0:074   |
|      B3              I:002                                                      |
|------| |-------------|/|-------------------------------------------------(L)----|
|      164              01                                                  12    |
|[394]                                                                            |
0:074/12 - -| |- - File #2 MAIN_PRGRM - 399
           -|/|- - File #2 MAIN_PRGRM - 400
           -(L)- - File #2 MAIN_PRGRM - 395
           -(U)- - File #2 MAIN_PRGRM - 398
```

```
COMPARE :   Rung #394
|                        DWELL 1      DWELL 2      HEATER 3                               |
|                        CHAMBER      CHAMBER      CHAMBER                                |
|  READY TO              GATE VALVE   GATE VALVE   GATE VALVE                 POLYCOLD    |
|  VENT                  CLOSED       CLOSED       CLOSED                     DEFROST     |
|  RTVCVDT               HV3S1        HV4S1        HV5S1                      PCDEF       |
|    T4:0                 I:004        I:022        I:024                      0:074      |
|--+--| |----------------+--| |--------| |---------| |--------------------------(L)------|
|  |  DN                 |   03           06           00                         12      |
|  |[392]                |                                                              |
|  |                     | 0:074/12 - -| |- - File #2 MAIN_PRGRM - 399                  |
|  |                     |            -|/|- - File #2 MAIN_PRGRM - 400                  |
|  |                     |            -(L)- - File #2 MAIN_PRGRM - 395                  |
|  |                     |            -(U)- - File #2 MAIN_PRGRM - 398                  |
|  |                     |                                                              |
|  |CHAMBER VENT         |                                                              |
|  |ENABLE DELAY         |                                                              |
|  |V2DYTMR              |                                                              |
|  |   T4:19             |                                                              |
|  +---| |---------------+                                                              |
|  |    DN               |                                                              |
|  |[393]                |                                                              |
|  |MANUAL               |                                                              |
|  |CONTROL   HEATER 2   |                                                              |
|  |CHAMBER   CHAMBER    |                                                              |
|  |VENT 2    GATE VALVE |                                                              |
|  |OPEN      CLOSE      |                                                              |
|  |M-CV2-1   HV2S1      |                                                              |
|  | N7:6       I:004    |                                                              |
|  +--| |----+---| |-----+                                                              |
|      12    |    00   |                                                                |
|   [3]      |         |                                                                |
|            |DOOR 4   |                                                                |
|            |CLOSED   |                                                                |
|            |DRCL4S   |                                                                |
|            | I:006   |                                                                |
|            +--| |----+                                                                |
|               06                                                                       |
```

BASE :   Rung #396

```
|                  POLYCOLD                                                      VENT DELAY          |
|VENT 2 REQUEST  SETPOINT HIGH                                                   TIMER               |
|VNT2_RQST       PCSPH                                                           VNTDLYTMR           |
|     B3           I:002                                                         ┌─TON──────────┐    |
|────┤ ├──────────┤ ├────────────────────────────────────────────────────────────┤TIMER ON DELAY├─(EN)─|
|     164           01                                                            |TIMER:   T4:80|    |
|(394)                                                                            |BASE (SEC): 1.0├─(DN)|
|                                                                                 |PRESET:      5|    |
|                                                                                 |ACCUM:       0|    |
|                                                                                 └──────────────┘    |
T4:80.DN - ┤ ├ - File #2 MAIN_PRGRM -  397
```

COMPARE :   Rung #395

```
|POLYCOLD                                                                        VENT DELAY          |
|DEFROST                                                                         TIMER               |
|PCDEF                                                                           VNTDLYTMR           |
|  O:074                                                                         ┌─TON──────────┐    |
|────┤ ├─────────────────────────────────────────────────────────────────────────┤TIMER ON DELAY├─(EN)─|
|     12                                                                          |TIMER:   T4:80|    |
|(395)                                                                            |BASE (SEC): 1.0├─(DN)|
|                                                                                 |PRESET:    180|    |
|                                                                                 |ACCUM:       0|    |
|                                                                                 └──────────────┘    |
T4:80 - TON - File #2 MAIN_PRGRM -  396
T4:80.DN - ┤ ├ - File #2 MAIN_PRGRM -  397
```

```
         -(U)- - File #2 MAIN_PRGRM    .1
Rung #397
|POLYCOLD                                                          POLYCOLD |
|SETPOINT HIGH                                                     DEFROST  |
|PCSPH                                                             PCDEF    |
|     I:002                                                         O:074   |
|------] [-----------------------------------------------------------(U)----|
|       01                                                            12    |
O:074/12 - ] [ - File #2 MAIN_PRGRM -  395,398
         ]/[ - File #2 MAIN_PRGRM -  399
         -(L)- - File #2 MAIN_PRGRM -  394
         -(U)- - File #2 MAIN_PRGRM -  397
Rung #398
|POLYCOLD WATER   POLYCOLD                                         POLYCOLD |
|ON               DEFROST                                   COMPRESSOR ON   |
|PC_H20           PCDEF                                            PCCOMP   |
|     I:066        O:074                                            O:074   |
|------] [---------+--] [------+-------------------------------------( )----|
|       10         |    12     |                                      10    |
|                  |[397]      |                                            |
|                  |POLYCOLD COOL                                           |
|                  |PC_COOL    |                                            |
|                  |    O:074  |                                            |
|                  +----] [----+                                            |
|                        11                                                  |
|                  [399]                                                     |
Rung #399
|CHROME      DWELL 1                                                        |
|CHAMBER     CHAMBER                                                        |
|=<250       GATE VALVE   POLYCOLD                                          |
|MICRONS     CLOSED       DEFROST                            POLYCOLD COOL  |
|PIR6        HV3S1        PCDEF                              PC_COOL        |
|  I:024       I:004        O:074                               O:074       |
|----] [----+----]/[----+----]/[-------------------------------( )----------|
|      07   |     03    |     12                                 11         |
|           |           |  [397]                                            |
|           |DWELL 2    |                                                   |
|           |CHAMBER    |                                                   |
|           |GATE VALVE |                                                   |
|           |CLOSED     |                                                   |
|           |HV4S1      |                                                   |
|           |   I:022   |                                                   |
|           +----]/[----+                                                   |
|           |     06    |                                                   |
|           |HEATER 3   |                                                   |
|           |CHAMBER    |                                                   |
|           |GATE VALVE |                                                   |
|           |CLOSED     |                                                   |
|           |HV5S1      |                                                   |
|           |   I:024   |                                                   |
|           +----]/[----+                                                   |
|                 00                                                        |
O:074/11 - ] [ - File #2 MAIN_PRGRM -  398
         -( )- - File #2 MAIN_PRGRM -  399
```

Rung #400

```
|VENT 3                                                          VENT 3 STAGE1     |
|STAGE 1                                                         DELAY TIMER       |
|V3ST1                                                           V3DYTMR           |
|  B3                                                            +-TON----------+  |
|--| |-----------------------------------------------------------+TIMER ON DELAY +-(EN)-|
|  416                                                           |TIMER:   T4:20|  |
|[423]                                                           |BASE (SEC): 1.0+-(DN) |
|                                                                |PRESET:      5|  |
|                                                                |ACCUM:       0|  |
|                                                                +--------------+  |
T4:20.DN - -| |- - File #2 MAIN_PRGRM -  401
```

Rung #401

```
|                          DWELL 3     DWELL 4     BUFFER 3                       |
|                          CHAMBER     CHAMBER     CHAMBER                 OPEN   |
| READY TO                 GATE VALVE  GATE VALVE  GATE VALVE              DWELL 3|
| VENT                     CLOSED      CLOSED      CLOSED                  VENT VALVE
| RTVCVDT                  HV6S1       HV7S1       HV8S1                   CV3    |
|   T4:0                     I:024       I:036       I:040                 O:027  |
|-+--| |----------------+------| |---------| |---------| |-----------------(L)----|
| |    DN               |      03          06          00                  16     |
| |[392]                |                                                       |
| |                     | O:027/16 - -| |- - File #5 FAULTS - 148                 |
| |                     |                    File #6 TECH_RUNGS - 0               |
| |                     |            -|/|- - File #2 MAIN_PRGRM - 368             |
| |                     |                    File #5 FAULTS - 150                 |
| |CHAMBER VENT 3       |            -(U)- - File #2 MAIN_PRGRM - 53              |
| |ENABLE DELAY         |                                                       |
| |V3DYTMR              |                                                       |
| |      T4:20          |                                                       |
| |--------| |----------|                                                       |
| |          DN         |                                                       |
| |[400]                |                                                       |
| |MANUAL               |                                                       |
| |CONTROL    HEATER 3  |                                                       |
| |CHAMBER    CHAMBER   |                                                       |
| |VENT 3     GATE VALVE|                                                       |
| |OPEN       CLOSED    |                                                       |
| |M-CV3-1    HV5S1     |                                                       |
| |  N7:6       I:024   |                                                       |
| +--| |----+---| |-----+                                                       |
|     13    |    00   |                                                         |
| [3]       |         |                                                         |
|           |DOOR 6   |                                                         |
|           |CLOSED   |                                                         |
|           |DRCL6S   |                                                         |
|           | I:026   |                                                         |
|           +--| |----+                                                         |
|               02                                                              |
```

Rung #402

```
|                                                                VENT 4 STAGE1     |
|VENT 4                                                          VENT 4 DELAY      |
|STAGE 1                                                         TIMER             |
|V4ST1                                                           V4CV4DYTMR        |
|  B3                                                            +-TON----------+  |
|--| |-----------------------------------------------------------+TIMER ON DELAY +-(EN)-|
|  418                                                           |TIMER:   T4:29|  |
|[428]                                                           |BASE (SEC): 1.0+-(DN) |
|                                                                |PRESET:      5|  |
|                                                                |ACCUM:       0|  |
|                                                                +--------------+  |
T4:29.DN - -| |- - File #2 MAIN_PRGRM -  403
```

```
Rung #403
|                                  DWELL 5      DWELL 6      BUFFER 4                                    |
|                                  CHAMBER      CHAMBER      CHAMBER                             OPEN    |
|  READY TO                        GATE VALVE   GATE VALVE   GATE VALVE                          DWELL 5 |
|  VENT                            CLOSED       CLOSED       CLOSED                              VENT VALVE
|  RTVCVDT                         HV9S1        HV10S1       HV11S1                              CV4     |
|    T4:0                            I:040        I:052        I:054                             O:043   |
|----| |----------------------+-------| |----------| |----------| |------------------------------(L)-----|
| |   DN                      |         03           06           00                              16     |
| |[392]                      |                                                                        |
| |                           | O:043/16 - -| |- - File #5 FAULTS - 152                                |
| |                           |                    File #6 TECH_RUNGS - 0                               |
| |                           |            -|/|- - File #2 MAIN_PRGRM - 368                             |
| |CHAMBER VENT 4             |                    File #5 FAULTS - 154                                 |
| |ENABLE TIME                |            -(U)- - File #2 MAIN_PRGRM - 55                              |
| |DELAY                      |                                                                        |
| |V4CV4DYTMR                 |                                                                        |
| |     T4:29                 |                                                                        |
| |-------| |-----------------|                                                                        |
| |        DN                 |                                                                        |
| |[402]                      |                                                                        |
| |MANUAL                     |                                                                        |
| |CONTROL      BUFFER 3      |                                                                        |
| |CHAMBER      CHAMBER       |                                                                        |
| |VENT 4       GATE VALVE    |                                                                        |
| |OPEN         CLOSED        |                                                                        |
| |M-CV4-1      HV8S1         |                                                                        |
| |  N7:6          I:040      |                                                                        |
| |---| |----+-----| |--------|                                                                        |
|      14    |      00     |                                                                           |
|  [3]       |             |                                                                           |
|            |DOOR 8       |                                                                           |
|            |CLOSED       |                                                                           |
|            |DRCL8S       |                                                                           |
|            |  I:042      |                                                                           |
|            |----| |------|                                                                           |
|                  02                                                                                   |
Rung #404
|LLOCK        DWELL 1      DWELL 3      DWELL 5      EXLOCK                                   ALL       |
|CHAMBER      CHAMBER      CHAMBER      CHAMBER      CHAMBER                                  CHAMBERS  |
|PRESSUR AT   PRESSUR AT   PRESSUR AT   PRESSUR AT   PRESSUR AT                               AT        |
|ATMOSPHERE   ATMOSPHERE   ATMOSPHERE   ATMOSPHERE   ATMOSPHERE                               ATMOSPHERE|
|PS2          PS3          PS4          PS5          PS6                                      CHBATMOS  |
|  I:002        I:002        I:022        I:036        I:052                                  B3        |
|----| |----------| |----------| |----------| |----------| |-------------------------------------( )-----|
|    04           05           04           04           04                                   383       |
B3/383 - -| |- - File #2 MAIN_PRGRM - 368
         -( )- - File #2 MAIN_PRGRM - 404
Rung #405
|            PUMPDOWN                 AUTO                                                              |
|VENT AREA   SYSTEM      PUMP AREA    MODE                                                 VENT AREA  |
|1           ENABLE      1 ENABLE     ENABLE                                               1 ENABLE   |
|TS14        PDSE        PUMP1E       AUTO                                                 VENT1E     |
|  N7:16       B3         N7:37       N7:37                                                  N7:37    |
|----| |--------|/|--------|/|--------|/|---[AFI]------------------------------------------------(L)-----|
|     6        303        13          11                                                      6       |
|[3]         [23]       [434]       [158]                                                             |
N7:37/6 - -| |- - File #2 MAIN_PRGRM - 34,110,200,216,406,408,409,684
          -|/|- - File #2 MAIN_PRGRM - 23,115,117,118,375,434
          -(L)- - File #2 MAIN_PRGRM - 405
          -(U)- - File #2 MAIN_PRGRM - 410
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2
```

```
N7:37/13 - -| |- - File #2 MAIN_PRGRM    26,27,105,167,183,200,216,408,435,436,455
           -|/|- - File #2 MAIN_PRGRM -  369,405
           -(L)- - File #2 MAIN_PRGRM -  434
           -(U)- - File #2 MAIN_PRGRM -  437
_F:N7:211X21 - BTW - File #2 MAIN_PRGRM -  2
```

Rung #435

```
|PUMP AREA  VENT AREA                                              PUMP SECTION 1      |
|1 ENABLE   ACTIVE                                                 TIMER               |
|PUMP1E     VNTACT                                                 PMP1TMR             |
|  N7:37      B3                                                   +-TON-----------+   |
|---| |--------|/|-------------------------------------------------+TIMER ON DELAY |-(EN)-|
|    13        343                                                 |TIMER:  T4:256 |   |
|[434]                                                             |BASE (SEC): 1.0|-(DN)|
|                                                                  |PRESET:    600 |   |
|                                                                  |ACCUM:       0 |   |
|                                                                  +---------------+   |
T4:256.DN - -| |- - File #2 MAIN_PRGRM -  609
```

Rung #436

```
|                                                                LLOCK                      |
|           ENABLE      ENABLE      OPEN                           CHAMBER                    |
|           CRYO        CRYO        LOAD LOCK                      ROUGH                      |
|PUMP AREA  COMPRESSOR  COMPRESSOR  CHAMBER     DOOR 1  DOOR 3  DOOR 4  VALVE           PUMP 1  |
|1 ENABLE   1           2           VENT VALVE  CLOSED  OPEN    CLOSED  CLOSED          STAGE 1 |
|PUMP1E     CY1         CY2         CV1         DRCL1S  DROP3S  DRCL4S  RVS1            P1ST1   |
|  N7:37      O:010       O:010       O:007     I:006   I:006   I:006   I:002             B3    |
|---| |--------| |---------| |---------|/|--------| |-----| |-----| |-----| |-------------( )---|
|    13         04          05          16       00      05      06      15               422   |
|[437]      [26]        [27]        [177]                                                       |
B3/422 - -| |- - File #2 MAIN_PRGRM -  68,115,117,118,437
        -( )- - File #2 MAIN_PRGRM -  436
```

Rung #406

```
|VENT AREA                                                    VENT SECTION 1
|1 ENABLE                                                     TIMER
|VENT1E                                                       VNT1TMR
|  N7:37                                                      +--TON--------------+
|----| |------------------------------------------------------|TIMER ON DELAY     |-(EN)-
|     6                                                       |TIMER:      T4:168 |
|[405]                                                        |BASE (SEC):    1.0 |-(DN)
|                                                             |PRESET:        180 |
|                                                             |ACCUM:           0 |
|                                                             +-------------------+
T4:168.DN - -| |- - File #2 MAIN_PRGRM - 608
```

Rung #407

```
| PALLET     PALLET      PALLET
| DETECTED   DETECTED    DETECTED                                    PALLET AT
| LEFT SIDE  RIGHT SIDE  LEFT SIDE                                   DOOR 4
| HEATER 2   HEATER 2    DWELL 1                                     PLT_DR4
| SEN10      SEN12       SEN13                                          B3
|    I:003      I:003       I:003
|----| |---+----| |--------| |-------------------------------------------( )---
|  |  11   |     13          14                                        247
|  |PALLLET| B3/247 - -|/|- - File #2 MAIN_PRGRM - 408
|  |DETECTED
|  |CENTER |
|  |DWELL 1|
|  |SEN14  |
|  | I:003 |
|  +--| |--+
|      15
```

Rung #408

```
|                PALLET     PALLET      PALLET     PALLET
|                DETECTED   DETECTED    DETECTED   DETECTED               DOOR CLOSE
|  VENT AREA     LEFT SIDE  RIGHT SIDE  LEFT SIDE  RIGHT SIDE  DOOR 4     SOLENOID
|  1 ENABLE      DWELL 1    HEATER 2    DWELL 1    DWELL 1     CLOSED     4 ENABLE
|  VENT1E        SEN13      SEN12       SEN13      SEN15       DRCL4S     DRCL4
|    N7:37          I:003      I:003       I:003      I:003      I:006       O:011
|-+-+--| |--+------|/|--------|/|-----+-----| |--------| |----+-----|/|--+--------+--( )--+-
| | |   6   |       14         13     |      14         16    |      06  |        |  06   |
| | |[410]  |                         |PALLET     PALLET      |          |        |       |
| | |       |                         |DETECTED   DETECTED    |          |        |MANUAL |
| | |       |                         |LEFT SIDE  RIGHT SIDE  |          |        |CONTROL                 MANUAL
| | |       |                         |DWELL 1    DWELL 1     |          |        |CLOSE DOOR  PALLET AT   DOOR 4
| | |PUMP AREA                        |SEN13      SEN15       |          |        |4           DOOR 4      OPEN
| | |1 ENABLE                         |   I:003      I:003    |          |        |M-DRCL4     PLT_DR4     MDR4OP
| | |PUMP1E |                         +----|/|--------|/|-----+          |        |   N7:10       B3         N7:32
| | |  N7:37|                              14         16                 |        +----| |--------|/|-----+--(U)---+
| | +--| |--+                                                            |             14        247      |   10
| |     13                                                               |        [3]          [407]      |
| |  [434]                                                               |                                |MANUAL
| |                                                                      |                                |DOOR 4
| |MANUAL                                                                |                                |CLOSE
| |CONTROL                                                               |                                |MDR4CL
| |CLOSE DOOR  PALLET AT                                                 |                                | N7:31
| |4           DOOR 4                                                    |                                +--(L)--
| |M-DRCL4     PLT_DR4                                                   |                                    14
| |   N7:10       B3                                                     |
| +----| |--------|/|------------------------------------------------------+
|       14        247
|  [3]          [407]
O:011/06 - -| |- - File #5 FAULTS - 23
```

```
                 File #6 TECH_RUNGS -
          -( )- - File #2 MAIN_PRGRM -  408
N7:32/10 - -(L)- - File #2 MAIN_PRGRM -  415
          -(U)- - File #2 MAIN_PRGRM -  408
_F:N7:211%21 - BTW - File #2 MAIN_PRGRM -  2
N7:31/14 - -(L)- - File #2 MAIN_PRGRM -  408
          -(U)- - File #2 MAIN_PRGRM -  415
_F:N7:211%21 - BTW - File #2 MAIN_PRGRM -  2
Rung #409
|                                    LLOCK                          OPEN                               |
|                                    CHAMBER  HEATER 1   HEATER 2    CAPACITANC                         |
|                                    ROUGH    CHAMBER    CHAMBER     MANOMETER                          |
|VENT AREA  DOOR 4   DOOR 2  DOOR 3  VALVE    GATE VALVE GATE VALVE  ISOLATION               VENT 1    |
|1 ENABLE   CLOSED   OPEN    OPEN    CLOSED   CLOSE      CLOSE       VALVE 1                 STAGE 1   |
|VENT1E     DRCL4S   DROP2S  DROP3S  RVS1     HV1S1      HV2S1       CMV1                    V1ST1     |
|  N7:37    I:006    I:006   I:006   I:002    I:002      I:004       O:010                     B3      |
|---] [-----] [-----] [-----] [-----] [-------] [--------] [---------]/[--------------------( )-------|
|    6       06       03      05      15       06         00          06                      412     |
|[410]                                                              [375]                              |
B3/412 - ] [ - - File #2 MAIN_PRGRM -  171,410
       -( )- - File #2 MAIN_PRGRM -  409
Rung #410
|          LLOCK                                                                                       |
|          CHAMBER                                                                                     |
|  VENT 1  PRESSUR AT                                                                   VENT AREA      |
|  STAGE 1 ATMOSPHERE                                                                   1 ENABLE       |
|  V1ST1   PS2                                                                          VENT1E         |
|    B3       I:002                                                                       N7:37        |
|-+---] [------] [----+--------------------------------------------------------------------(U)--------|
| |  412        04    |                                                                      6         |
| |[409]              |                                                                                |
| |                   | N7:37/6 - ] [ - - File #2 MAIN_PRGRM - 34, 110, 200, 216, 406, 408, 409, 684   |
| |                   |          ]/[ - - File #2 MAIN_PRGRM - 23, 115, 117, 118, 375, 434              |
| |                   |          -(L)- - File #2 MAIN_PRGRM - 405                                      |
| |                   | _F:N7:211%21 - BTW - File #2 MAIN_PRGRM - 2                                    |
| |ABORT SYSTEM       |                                                                                |
| |VENT               |                                                                                |
| |BORT_SYS_VNT       |                                                                                |
| |    N7:17          |                                                                                |
| |-----] [-----------|                                                                                |
| |      10           |                                                                                |
| |[3]                |                                                                                |
| |PREPARE FOR        |                                                                                |
| |AUTO RUN           |                                                                                |
| |>AUTO              |                                                                                |
| |    N7:37          |                                                                                |
| +-----] [-----------+                                                                                |
|        1                                                                                             |
| [162]                                                                                                |
Rung #411
|       PUMPDOWN             AUTO                                                                      |
|AREA 2 SYSTEM   PUMP AREA  MODE                                                        VENT AREA     |
|VENT   ENABLE   2 ENABLE   ENABLE                                                      2 ENABLE      |
|TS15   PDSE     PUMP2E     AUTO                                                        VENT2E        |
| N7:16    B3      N7:37     N7:37                                                        N7:37       |
|--] [-----]/[------]/[-------]/[---[AFI]----------------------------------------------------(L)-------|
|   7     303        14        11                                                            7        |
|[3]    [23]      [438]     [158]                                                                     |
N7:37/7 - ] [ - - File #2 MAIN_PRGRM -  35,111,229,412,414,415,416
          ]/[ - - File #2 MAIN_PRGRM -  23,117,118,119,120,121,122,123,124,376,438
          -(L)- - File #2 MAIN_PRGRM -  411
          -(U)- - File #2 MAIN_PRGRM -  417
```

```
_F:N7:21(X21 - BTW - File #2 MAIN_PRGRM   2
Rung #412
|VENT AREA                                                  VENT SECTION 2
|2 ENABLE                                                   TIMER
|VENT2E                                                     VNT2TMR
|  N7:37                                                    +-TON-----------------+
|---] [-----------------------------------------------------|TIMER ON DELAY       |-(EN)-
|    7                                                      |TIMER:       T4:199  |
|[411]                                                      |BASE (SEC):     1.0  |-(DN)
|                                                           |PRESET:         300  |
|                                                           |ACCUM:            0  |
|                                                           +---------------------+
T4:199.DN - ] [ - File #2 MAIN_PRGRM - 608
Rung #413
|            PALLET      PALLET
|  PALLET    DETECTED    DETECTED
|  CENTER    RIGHT SIDE  LEFT SIDE                              PALLET AT
|  BUFFER 2  HEATER 3    DWELL 3                                DOOR 5 AND 6
|  SEN23     SEN24       SEN25                                  PLT_DR5,6
|   I:023     I:023       I:023                                     B3
|--+--] [--+---] [---------] [--------------------------------------( )---
|  |   07   |    10          11                                      249
|  |PALLET  | B3/249 - ]/[ - File #2 MAIN_PRGRM - 414, 420
|  |DETECTED|
|  |CENTER  |
|  |DWELL 3 |
|  |SEN26   |
|  | I:023  |
|  +--] [---+
|      12
Rung #414
|               PALLET     PALLET       PALLET      PALLET
|               DETECTED   DETECTED     DETECTED    DETECTED                 DOOR CLOSE
|  VENT AREA    LEFT SIDE  RIGHT SIDE   LEFT SIDE   RIGHT SIDE  DOOR 5       SOLENOID
|  2 ENABLE     HEATER 3   HEATER 3     DWELL 3     DWELL 3     CLOSED       5 ENABLE
|  VENT2E       SEN22      SEN24        SEN25       SEN27       DRCL5S       DRCL5
|    N7:37      I:023      I:023        I:023       I:023       I:026        O:031
|--+--+--] [--+---]/[--------]/[-----+----] [---------] [----+----]/[--+--------( )--------+
|  |  |   7   |    06         10     |     11          13    |    00    |         00        |
|  |  |[411]  |                      |PALLET      PALLET     |          |MANUAL             |
|  |  |       |                      |DETECTED    DETECTED   |          |CONTROL            |  MANUAL
|  |  |       |                      |LEFT SIDE   RIGHT SIDE |          |CLOSE DOOR  PUMP AREA  DOOR 5
|  |  |       |                      |DWELL 3     DWELL 3    |          |5           5 ENABLE   OPEN
|  |  |PUMP AREA                     |SEN25       SEN27      |          |M-DRCL5     PUMP5E     MDR5OP
|  |  |2 ENABLE                      |  I:023      I:023     |          |  N7:10      N7:38      N7:32
|  |  |PUMP2E                        +---]/[-------]/[-------+          +---] [-------]/[---+----(U)----+
|  |  |  N7:37                            11          13                      15          1   |    11
|  |  +--] [--+                                                            [3]       [451]    |MANUAL
|  |     14                                                                                   |DOOR 5
|  | [438]                                                                                    |CLOSE
|  |MANUAL                                                                                    |MDR5CL
|  |CONTROL                                                                                   | N7:31
|  |CLOSE DOOR  PALLET AT                                                                     +--(L)--+
|  |5           DOOR 5 AND 6                                                                      15
|  |M-DRCL5     PLT_DR5,6
|  |  N7:10        B3
|  +--] [---------]/[------------------------------------------+
|      15         249
|  [3]         [413]
```

```
O:031/00 - -| |- - File #5 FAULTS -  2
                   File #6 TECH_RUNGS -  2
         -( )- - File #2 MAIN_PRGRM -  414
N7:32/11 - -(L)- - File #2 MAIN_PRGRM -  46
         -(U)- - File #2 MAIN_PRGRM -  414
_F:N7:21lX21 - BTW - File #2 MAIN_PRGRM -  2
N7:31/15 - -(L)- - File #2 MAIN_PRGRM -  414
         -(U)- - File #2 MAIN_PRGRM -  46
_F:N7:21lX21 - BTW - File #2 MAIN_PRGRM -  2
Rung #415
|  PUMPDOWN                                                          DOOR OPEN
|  SYSTEM              DOOR 4                                        SOLENOID
|  ENABLE              OPEN                                          4 ENABLE
|  PDSE                DROP4S                                        DROP4
|     B3                I:006                                          O:011
+---] [----------+------]/[------+-----------------------------------+---( )---+
|    303         |       07      |                                   |    07   |
|  [23]          |               |                                   |         |
|                |               |                                   |MANUAL   |
|                |               |                                   |CONTROL      DOOR OPEN     MANUAL
|                |               |                                   |OPEN DOOR    SOLENOID      DOOR 4
|                |               |                                   |4            4 ENABLE      OPEN
|VENT AREA  DOOR 3               |                                   |M-DROP4      DROP4         MDR4OP
|2 ENABLE   CLOSED               |                                   |  N7:11       O:011         N7:32
|VENT2E     DRCL3S               |                                   +---] [---------] [-------+---(L)---+
|  N7:37     I:006               |                                       10           07       |    10
+---] [------] [--+              |                                   [3]          [415]        |
|    7        04                 |                                                             |MANUAL
|[417]                           |                                                             |DOOR 4
|                                |                                                             |CLOSE
|PUMP AREA  DOOR 3               |                                                             |MDR4CL
|2 ENABLE   CLOSED               |                                                             | N7:31
|PUMP2E     DRCL3S               |                                                             +---(U)---+
|  N7:37     I:006               |                                                                  14
+---] [------] [--+              |
|    14        04                |
| [438]                          |
|                     HEATER 1   CHROME
|                     CHAMBER    CHAMBER
| PREPARE FOR         =<250      =<250
| AUTO RUN            MICRONS    MICRONS
| >AUTO               PIR2       PIR6
|     N7:37            I:004      I:024
+-----] [-------+---+----] [--------] [----+
|       1       |   |     10          07   |
|[162]          |   |                      |
|               |   |HEATER 1   CHROME     |
|               |   |CHAMBER    CHAMBER    |
|MANUAL         |   |=<250      =<250      |
|CONTROL        |   |MICRONS    MICRONS    |
|OPEN DOOR      |   |PIR2       PIR6       |
|4              |   |  I:004      I:024    |
|M-DROP4        |   +----]/[--------]/[----+
|   N7:11       |        10          07
+----] [--------+
       10
 [3]
O:011/07 - -| |- - File #2 MAIN_PRGRM -  415
                   File #5 FAULTS -  47
```

```
                    File #6 TECH_RUNGS     2
            -( )- - File #2 MAIN_PRGRM -  415
N7:32/10 - -(L)- - File #2 MAIN_PRGRM -  415
            -(U)- - File #2 MAIN_PRGRM -  408
_F:N7:21lX21 - BTW - File #2 MAIN_PRGRM -  2
N7:31/14 - -(L)- - File #2 MAIN_PRGRM -  408
            -(U)- - File #2 MAIN_PRGRM -  415
_F:N7:21lX21 - BTW - File #2 MAIN_PRGRM -  2
Rung #416
|                                                                          OPEN                     DWELL 2
|                                 HEATER 2   DWELL 1    DWELL 2    HEATER 3  CAPACITANC  RGA 2     CHAMBER
|                                 CHAMBER    CHAMBER    CHAMBER    CHAMBER   MANOMETER   ISOLATION ROUGH
|VENT AREA DOOR 3  DOOR 4  DOOR 5 GATE VALVE GATE VALVE GATE VALVE GATE VALVE ISOLATION VALVE    VALVE RV2   VENT 2
|2 ENABLE  CLOSED  OPEN    CLOSED CLOSE      CLOSED     CLOSED     CLOSED    VALVE 2     CLOSED    CLOSED      STAGE 1
|VENT2E    DRCL3S  DROP4S  DRCL5S HV2S1      HV3S1      HV4S1      HV5S1     CHV2        RGAS3     RVS3        V2ST1
|  N7:37   I:006   I:006   I:026  I:004      I:004      I:022      I:024     O:030       I:025     I:022       B3
|---| |-----| |-----| |-----| |------| |--------| |--------| |--------| |--------|/|--------| |--------| |--------( )--
|    7       04      07      00      00         03         06         00        06          16          15         414
|[417]                                                                         [376]
B3/414 - -| |- - File #2 MAIN_PRGRM -  393,417
         -( )- - File #2 MAIN_PRGRM -  416
Rung #417
|          DWELL 1     DWELL 1
|          CHAMBER     CHAMBER                                                               VENT AREA
|  VENT 2  PRESSUR AT  VENT VALVE                                                            2 ENABLE
|  STAGE 1 ATMOSPHERE  OPEN                                                                  VENT2E
|  V2ST1   PS3         CVS4                                                                    N7:37
|    B3      I:002       I:002
|---| |-------| |--------| |---+-------------------------------------------------------------(U)--
| |  414      05          14   |                                                                 7
| |[416]                       |
| |                            | N7:37/7 - -| |- - File #2 MAIN_PRGRM - 35, 111, 229, 412, 414, 415, 416
| |                            |           -|/|- - File #2 MAIN_PRGRM - 23, 117, 118, 119, 120, 121, 122, 123, 124,
| |                            |                   376, 438
| |                            |           -(L)- - File #2 MAIN_PRGRM - 417
| |ABORT SYSTEM                | _F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2
| |VENT                        |
| |BORT_SYS_VNT                |
| |   N7:17                    |
| |----| |---------------------|
| |     10                     |
| |[3]                         |
| |PREPARE FOR                 |
| |AUTO RUN                    |
| |>AUTO                       |
| |   N7:37                    |
| |----| |---------------------|
|        1
|  [162]
Rung #418
|        PUMPDOWN             AUTO
|AREA 3  SYSTEM   PUMP AREA   MODE                                                           VENT AREA
|VENT    ENABLE   3 ENABLE    ENABLE                                                         3 ENABLE
|TS16    POSE     PUMP3E      AUTO                                                           VENT3E
| N7:16    B3       N7:37     N7:37                                                            N7:37
|--| |-----|/|-------|/|-------|/|--[AF]-----------------------------------------------------(L)--
|   8      303       15        11                                                              8
|[3]      [23]     [442]     [158]
N7:37/8 - -| |- - File #2 MAIN_PRGRM -  36,43,112,419,420,422,423
          -|/|- - File #2 MAIN_PRGRM -  23,125,126,127,128,129,130,377,442
          -(L)- - File #2 MAIN_PRGRM -  418
          -(U)- - File #2 MAIN_PRGRM -  424
```

```
_F:N7:21[X21 - BTW - File #2 MAIN_PRG      2
Rung #419
|VENT AREA                                                                  VENT SECTION 3       |
|3 ENABLE                                                                   TIMER                |
|VENT3E                                                                     VNT3TMR              |
|  N7:37                                                                    +-TON---------------+|
|--] [--------------------------------------------------------------------+-|TIMER ON DELAY     |-(EN)-|
|   8                                                                       |TIMER:     T4:242  |     |
|[418]                                                                      |BASE (SEC):   1.0  |-(DN) |
|                                                                           |PRESET:       300  |     |
|                                                                           |ACCUM:          0  |     |
|                                                                           +-------------------+     |
T4:242.DN - ] [ - File #2 MAIN_PRGRM -  608
Rung #420
|              PALLET      PALLET        PALLET      PALLET                                            |
|              DETECTED    DETECTED      DETECTED    DETECTED                 DOOR CLOSE                |
|  VENT AREA   LEFT SIDE   RIGHT SIDE    LEFT SIDE   RIGHT SIDE   DOOR 6      SOLENOID                  |
|  3 ENABLE    HEATER 3    HEATER 3      DWELL 3     DWELL 3      CLOSED      6 ENABLE                  |
|  VENT3E      SEN22       SEN24         SEN25       SEN27        DRCL6S      DRCL6                     |
|    N7:37       I:023       I:023         I:023       I:023       I:026        O:031                   |
|-+-+--] [----+---]/[--------]/[------+----]/[---------]/[----+----]/[----+-+-----( )-------------+-+-|
| | |    8    |     06          10    |     11           13   |     02    | |      02             | |
| | |[418]    |                       |                           |         | |                     | |
| | |         |                       |PALLET      PALLET       |         | |MANUAL               | |
| | |         |                       |DETECTED    DETECTED     |         | |CONTROL        MANUAL| |
| | |         |                       |LEFT SIDE   RIGHT SIDE   |         | |CLOSE DOOR  PALLET AT  DOOR 6| |
| | |         |                       |DWELL 3     DWELL 3      |         | |6          DOOR 5 AND 6 OPEN | |
| | |PUMP AREA|                       |SEN25       SEN27        |         | |M-DRCL6    PLT_DR5,6  MDR6OP| |
| | |3 ENABLE |                       |  I:023       I:023      |         | |  N7:11       B3      N7:32 | |
| | |PUMP3E   |                       +---] [---------] [-------+         | +---] [--------]/[----+-(U)-+ |
| | |  N7:37  |                             11          13                |      0         249   |  12 |   |
| | +--] [----+                                                           |    [3]       [413]   |     |   |
| |      15                                                               |                      |     |   |
| |  [442]                                                                |                      |MANUAL|  |
| |                                                                       |                      |DOOR 6|  |
| |                                                                       |                      |CLOSE |  |
| |MANUAL                                                                 |                      |MDR6CL|  |
| |CONTROL                                                                |                      | N7:32|  |
| |CLOSE DOOR  PALLET AT                                                  |                      +-(L)--+  |
| |6           DOOR 5 AND 6                                               |                         0      |
| |M-DRCL6     PLT_DR5,6                                                  |                                |
| |  N7:11       B3                                                       |                                |
| +---] [--------]/[------------------------------------------------------+                                |
|      0         249                                                                                      |
|  [3]         [413]                                                                                      |
O:031/02 - ] [ - File #5 FAULTS -  27
                 File #6 TECH_RUNGS -  2
         -( )- - File #2 MAIN_PRGRM -  420
N7:32/12 - -(L)- - File #2 MAIN_PRGRM -  47
         -(U)- - File #2 MAIN_PRGRM -  420
_F:N7:21[X21 - BTW - File #2 MAIN_PRGRM -  2
N7:32/0 - -(L)- - File #2 MAIN_PRGRM -  420
        -(U)- - File #2 MAIN_PRGRM -  47
_F:N7:21[X21 - BTW - File #2 MAIN_PRGRM -  2
```

Rung #421

PALLET CENTER BUFFER 3 SEN35 I:037 07
PALLET DETECTED RIGHT SIDE BUFFER 3 SEN36 I:037 10
PALLET DETECTED LEFT SIDE DWELL 5 SEN37 I:037 11
PALLET AT DOOR 7 AND 8 PLT_DR7,8 B3 ( ) 296
PALLET DETECTED CENTER DWELL 5 SEN38 I:037 12

B3/296 - -|/|- - File #2 MAIN_PRGRM - 422, 427

Rung #422

VENT AREA 3 ENABLE VENT3E N7:37 8 [424]
PALLET DETECTED LEFT SIDE BUFFER 3 SEN34 I:037 /06
PALLET DETECTED RIGHT SIDE BUFFER 3 SEN36 I:037 /10
PALLET DETECTED LEFT SIDE DWELL 5 SEN37 I:037 11
PALLET DETECTED RIGHT SIDE DWELL 5 SEN39 I:037 13
DOOR 7 CLOSED DRCL7S I:042 /00
DOOR CLOSE SOLENOID 7 ENABLE DRCL7 O:045 ( ) 00

PUMP AREA 3 ENABLE PUMP3E N7:37 15 [442]
PALLET DETECTED LEFT SIDE DWELL 5 SEN37 I:037 /11
PALLET DETECTED RIGHT SIDE DWELL 5 SEN39 I:037 /13

MANUAL CONTROL CLOSE DOOR 7 M-CRCL7 N7:11 1 [3]
PALLET AT DOOR 7 AND 8 PLT_DR7,8 B3 /296 [421]

MANUAL CONTROL CLOSE DOOR 7 M-CRCL7 N7:11 1 [3]
PALLET AT DOOR 7 AND 8 PLT_DR7,8 B3 /296 [421]
MANUAL DOOR 7 OPEN MDR7OP N7:32 (U) 13
MANUAL DOOR 7 CLOSE MDR7CL N7:32 (L) 1

```
O:045/00 - -| |- - File #5 FAULTS -  29
                   File #6 TECH_RUNGS -  3
           -( )- - File #2 MAIN_PRGRM -  422
N7:32/13 - -(L)- - File #2 MAIN_PRGRM -  48
           -(U)- - File #2 MAIN_PRGRM -  422
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM -  2
N7:32/1 - -(L)- - File #2 MAIN_PRGRM -  422
          -(U)- - File #2 MAIN_PRGRM -  48
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM -  2
```

Rung #423

```
                                 DWELL 3     DWELL 4     BUFFER 3    DWELL 2                 OPEN
                                 CHAMBER     CHAMBER     CHAMBER     CHAMBER     RGA 2       CAPACITANC
                                 GATE VALVE  GATE VALVE  GATE VALVE  ROUGH       ISOLATION   MANOMETER
 VENT AREA   DOOR 6    DOOR 7    CLOSED      CLOSED      CLOSED      VALVE RV2   VALVE       ISOLATION       VENT 3
 3 ENABLE    CLOSED    CLOSED    HV6S1       HV7S1       HV8S1       CLOSED      CLOSED      VALVE 3         STAGE 1
 VENT3E      DRCL6S    DRCL7S                                        RVS3        RGAS3       CMV3            V3ST1
   N7:37     I:026     I:042     I:024       I:036       I:040       I:022       I:025       O:044           B3
|----] [------] [-------] [-------] [---------] [---------] [---------] [---------] [---------]/[-------------( )--|
      8        02        00        03          06          00          15          16          06             416
 [424]                                                                                      [377]
B3/416 - ] [ - File #2 MAIN_PRGRM - 400,424
         -( )- - File #2 MAIN_PRGRM - 423
```

Rung #424

```
            DWELL 3      DWELL 3
            CHAMBER      CHAMBER
 VENT 3     PRESSUR AT   VENT VALVE                                                             VENT AREA
 STAGE 1    ATMOSPHERE   OPEN                                                                   3 ENABLE
 V3ST1      PS4          CVS6                                                                   VENT3E
   B3       I:022        I:022                                                                    N7:37
|--+--] [------] [--------] [----+-----------------------------------------------------------------(U)---|
|  |  416       04          12   |                                                                   8
|  | [423]                       |
|  |                             | N7:37/8 - ] [ - File #2 MAIN_PRGRM - 36, 43, 112, 419, 420, 422, 423
|  |                             |          ]/[ - File #2 MAIN_PRGRM - 23, 125, 126, 127, 128, 129, 130, 377, 442
|  |                             |          -(L)- - File #2 MAIN_PRGRM - 418
|  |                             | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2
|  |ABORT SYSTEM                 |
|  |VENT                         |
|  |BORT_SYS_VNT                 |
|  |   N7:17                     |
|  +----] [----------------------+
|  |    10                       |
|  | [3]                         |
|  |PREPARE FOR                  |
|  |AUTO RUN                     |
|  |>AUTO                        |
|  |   N7:37                     |
|  +----] [----------------------+
|        1
  [162]
```

Rung #425

```
        PUMPDOWN               AUTO
 AREA 4 SYSTEM     PUMP AREA   MODE                                                             VENT AREA
 VENT   ENABLE     4 ENABLE    ENABLE                                                           4 ENABLE
 TS17   PDSE       PUMP4E      AUTO                                                             VENT4E
 N7:16    B3        N7:38      N7:37                                                              N7:37
|--] [------]/[-------]/[-------]/[---[AFI]---------------------------------------------------------(L)---|
    9      303        0         11                                                                   9
 [3]      [23]      [447]      [158]
N7:37/9 - ] [ - File #2 MAIN_PRGRM - 37,113,329,426,427,428
          ]/[ - File #2 MAIN_PRGRM - 23,131,132,133,134,135,136,378,447
          -(L)- - File #2 MAIN_PRGRM - 425
          -(U)- - File #2 MAIN_PRGRM - 429
_F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2
```

```
Rung #426
|VENT AREA                                                              VENT SECTION 4
|4 ENABLE                                                               TIMER
|VENT4E                                                                 VNT4TMR
|   N7:37                                                               +-TON-----------------+
|---] [-----------------------------------------------------------------|TIMER ON DELAY       |-(EN)-
|    9                                                                  |TIMER:        T4:248 |
|[425]                                                                  |BASE (SEC):      1.0 |-(DN)
|                                                                       |PRESET:          300 |
|                                                                       |ACCUM:             0 |
|                                                                       +---------------------+
T4:248.DN - -] [- - File #2 MAIN_PRGRM -  608
Rung #427
|                PALLET      PALLET      PALLET      PALLET
|                DETECTED    DETECTED    DETECTED    DETECTED                 DOOR CLOSE
|   VENT AREA    LEFT SIDE   RIGHT SIDE  LEFT SIDE   RIGHT SIDE   DOOR 8      SOLENOID
|   4 ENABLE     BUFFER 3    BUFFER 3    DWELL 5     DWELL 5      CLOSED      8 ENABLE
|   VENT4E       SEN34       SEN36       SEN37       SEN39        DRCL8S      DRCL8
|      N7:37       I:037       I:037       I:037       I:037       I:042        O:045
|-+-+-+--] [--+----]/[---------]/[------+----] [---------] [---+----]/[--+----+----( )----+-
| | |     9   |      06          10     |     11          13   |     02   |    |     02    |
| | |[425]    |                         |PALLET      PALLET    |          |    |           |
| | |         |                         |DETECTED    DETECTED  |          |    |MANUAL     |
| | |         |                         |LEFT SIDE   RIGHT SIDE|          |    |CONTROL                  MANUAL
| | |         |                         |DWELL 5     DWELL 5   |          |    |CLOSE DOOR  PALLET AT    DOOR 8
| | |PUMP AREA|                         |SEN37       SEN39     |          |    |8           DOOR 7 AND 8 OPEN
| | |4 ENABLE |                         |   I:037       I:037  |          |    |M-CRCL8     PLT_DR7,8    MDR8OP
| | |PUMP4E   |                         +----]/[---------]/[---+          |    |  N7:11         83        N7:32
| | |   N7:38 |                              11          13               |    +---] [---------]/[----+---(U)---+
| | +---] [---+                                                           |         2          296     |    14
| | |     0   |                                                           |    [3]        [421]        |
| | |[447]    |                                                           |                            |MANUAL
| | |         |                                                           |                            |DOOR 8
| | |MANUAL   |                                                           |                            |CLOSE
| | |CONTROL  |                                                           |                            |MDR8CL
| | |CLOSE DOOR                                                           |                            | N7:32
| | |8        |                                                           |                            +---(L)---+
| | |M-CRCL8  |                                                           |                                 2
| | |  N7:11  |                                                           |
| | +---] [---+                                                           |
| |       2                                                               |
| |  [3]                                                                  |
| |MANUAL                                                                 |
| |CONTROL                                                                |
| |CLOSE DOOR  PALLET AT                                                  |
| |8           DOOR 7 AND 8                                               |
| |M-CRCL8     PLT_DR7,8                                                  |
| |  N7:11         83                                                     |
| +---] [---------]/[-----------------------------------------------------+
|       2          296
|  [3]         [421]
O:045/02 - -] [- - File #5 FAULTS -  31
                   File #6 TECH_RUNGS -  3
           -( )- - File #2 MAIN_PRGRM -  427
N7:32/14 - -(L)- - File #2 MAIN_PRGRM -  49
           -(U)- - File #2 MAIN_PRGRM -  427
_F:N7:21(%21 - BTW - File #2 MAIN_PRGRM -  2
N7:32/2 - -(L)- - File #2 MAIN_PRGRM -  427
          -(U)- - File #2 MAIN_PRGRM -  49
_F:N7:21(%21 - BTW - File #2 MAIN_PRGRM -  2
```

Rung #428

```
|                                                            DWELL 5                OPEN                                  |
|                                     DWELL 5     DWELL 6     BUFFER 4    CHAMBER    RGA 4      CAPACITANC                 |
|                                     CHAMBER     CHAMBER     CHAMBER     ROUGH      ISOLATION  MANOMETER                  |
|VENT AREA  DOOR 8    DOOR 9    GATE VALVE  GATE VALVE  GATE VALVE  VALVE      VALVE      ISOLATION            VENT 4     |
|4 ENABLE   CLOSED    CLOSED    CLOSED      CLOSED      CLOSED      CLOSED     CLOSED     VALVE 4              STAGE 1    |
|VENT4E     DRCL8S    DRCL9S    HV9S1       HV10S1      HV11S1      RVS7       RGAS7      CMV4                 V4ST1      |
|  N7:37    I:042     I:056     I:040       I:052       I:054       I:052      I:055      O:060                B3         |
|---| |------| |------| |------| |---------| |---------| |---------| |--------| |---------|/|-----------------( )----|
|    9        02        00        03          06          00          14         16         06                   418        |
|[429]                                                                                    [378]                           |
B3/418 - -| |- - File #2 MAIN_PRGRM -  402,429
         -( )- - File #2 MAIN_PRGRM -  428
```

Rung #429

```
|            DWELL 5     DWELL 5                                                                                           |
|            CHAMBER     CHAMBER                                                                                           |
| VENT 4     VENT VALVE  PRESSUR AT                                                                        VENT AREA       |
| STAGE 1    OPEN        ATMOSPHERE                                                                        4 ENABLE        |
| V4ST1      CVS8        PS5                                                                               VENT4E          |
|   B3       I:036       I:036                                                                             N7:37           |
|-+--| |------| |---------| |----+--------------------------------------------------------------------------(U)----|
| |  418        12          04    |                                                                          9             |
| |[428]                          |                                                                                        |
| |                               | N7:37/9 - -| |- - File #2 MAIN_PRGRM - 37, 113, 329, 426, 427, 428                   |
| |                               |           -|/|- - File #2 MAIN_PRGRM - 23, 131, 132, 133, 134, 135, 136, 378, 447     |
| |                               |           -(L)- - File #2 MAIN_PRGRM - 425                                           |
| |                               | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                                          |
| |ABORT SYSTEM                   |                                                                                        |
| |VENT                           |                                                                                        |
| |BORT_SYS_VNT                   |                                                                                        |
| |    N7:17                      |                                                                                        |
| |-----| |---------------------+                                                                                        |
| |     10                        |                                                                                        |
| |[3]                            |                                                                                        |
| |PREPARE FOR                    |                                                                                        |
| |AUTO RUN                       |                                                                                        |
| |>AUTO                          |                                                                                        |
| |    N7:37                      |                                                                                        |
| +-----| |---------------------+                                                                                        |
|       1                                                                                                                  |
|  [162]                                                                                                                   |
```

Rung #430

```
|          PUMPDOWN              AUTO                                                                                      |
|AREA 5    SYSTEM    PUMP AREA   MODE                                                                    VENT AREA       |
|VENT      ENABLE    5 ENABLE    ENABLE                                                                  5 ENABLE        |
|TS18      PDSE      PUMP5E      AUTO                                                                    VENT5E          |
| N7:16     B3        N7:38      N7:37                                                                     N7:37          |
|---| |------|/|--------|/|-------|/|---[AFI]-------------------------------------------------------------(L)----|
|   10       303        1          11                                                                        10            |
|[3]       [23]       [451]      [158]                                                                                     |
N7:37/10 - -| |- - File #2 MAIN_PRGRM -  114,327,335,431,432,698
           -|/|- - File #2 MAIN_PRGRM -  23,137,138,451
           -(L)- - File #2 MAIN_PRGRM -  430
           -(U)- - File #2 MAIN_PRGRM -  433
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM -  2
```

Rung #431

```
|VENT AREA                                                                          VENT SECTION 5          |
|5 ENABLE                                                                           TIMER                   |
|VENT5E                                                                             VNT5TMR                 |
|  N7:37                                                                            +-TON--------------+    |
|---| |-----------------------------------------------------------------------------|TIMER ON DELAY    |-(EN)-|
|    10                                                                             |TIMER:    T4:252  |    |
|[430]                                                                              |BASE (SEC):  1.0  |-(DN) |
|                                                                                   |PRESET:      180  |    |
|                                                                                   |ACCUM:         0  |    |
|                                                                                   +------------------+    |
T4:252.DN - -| |- - File #2 MAIN_PRGRM -  608
```

Rung #432

```
|             EXLOCK                                                                                 |
|             CHAMBER   EXITLOCK                                                                     |
|             ROUGH     CHAMBER                                                                      |
|VENT AREA    VALVE     GATE VALVE   DOOR 10   DOOR 11                                   VENT 5     |
|5 ENABLE     CLOSED    CLOSED       CLOSED    OPEN                                      STAGE 1    |
|VENT5E       RVS9      HV12S1       DRCL10S   DROP11S                                   V5ST1      |
|  N7:37      I:052     I:054        I:056     I:056                                     B3         |
|---| |--------| |-------| |----------| |------| |------------------------------------------( )------|
|    10          16        03           02        05                                      420       |
|[433]                                                                                              |
B3/420 - -| |- - File #2 MAIN_PRGRM -  344,351,433
         -( )- - File #2 MAIN_PRGRM -  432
```

Rung #433

```
|             EXLOCK                                                                                 |
|             CHAMBER                                                                                |
|  VENT 5     PRESSUR AT                                                              VENT AREA     |
|  STAGE 1    ATMOSPHERE                                                              5 ENABLE      |
|  V5ST1      PS6                                                                     VENT5E        |
|    B3       I:052                                                                     N7:37       |
|-+---| |------| |--+------------------------------------------------------------------(U)---------|
| |   420         04 |                                                                   10         |
| |[432]             |                                                                            |
| |                  | N7:37/10 - -| |- - File #2 MAIN_PRGRM - 114, 327, 335, 431, 432, 698          |
| |                  |            -|/|- - File #2 MAIN_PRGRM - 23, 137, 138, 451                      |
| |                  |            -(L)- - File #2 MAIN_PRGRM - 430                                  |
| |                  | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                                  |
| |ABORT SYSTEM      |                                                                            |
| |VENT              |                                                                            |
| |BORT_SYS_VNT      |                                                                            |
| |    N7:17         |                                                                            |
| |------| |---------+                                                                            |
| |       10         |                                                                            |
| |[3]               |                                                                            |
| |PREPARE FOR       |                                                                            |
| |AUTO RUN          |                                                                            |
| |>AUTO             |                                                                            |
| |    N7:37         |                                                                            |
| +------| |---------+                                                                            |
|         1                                                                                         |
|  [162]                                                                                            |
```

Rung #434

```
|            HEATER 1     HEATER 2                                                                   |
|            CHAMBER      CHAMBER      PIRANI                SYSTEM                                  |
|PUMP AREA   GATE VALVE   GATE VALVE   GUAGE 1    DOOR 2     VENT      VENT AREA         PUMP AREA   |
|1           CLOSE        CLOSE        NO FAULT   OPEN       ENABLE    1 ENABLE          1 ENABLE    |
|TS21        HV1S1        HV2S1        PGNF1      DROP2S     SYSVNTE   VENT1E            PUMP1E      |
|  N7:16     I:002        I:004        I:004      I:006      N7:37     N7:37               N7:37     |
|---| |--------| |----------| |----------| |--------| |--------|/|-------|/|-----------------(L)-------|
|    13          06           00           14         03         5         6                 13      |
|[3]                                                         [369]     [410]                         |
```

```
Rung #437
            HEATER 1   HEATER 2
            CHAMBER    CHAMBER
 PUMP 1     GATE VALVE GATE VALVE                                  PUMP AREA
 STAGE 1    OPEN       OPEN                                        1 ENABLE
 P1ST1      HV1S3      HV2S3                                       PUMP1E
   B3        I:002      I:004                                        N7:37
|--] [------] [------] [----+-------------------------------------------(U)---|
  422         10        02  |                                             13
 [436]                      |
                            | N7:37/13 - ] [ - File #2 MAIN_PRGRM - 26, 27, 105, 167,
                            |        183, 200, 216, 408, 435, 436, 455
                            |        ]/[ - File #2 MAIN_PRGRM - 369, 405
                            |        -(L)- - File #2 MAIN_PRGRM - 434
                            | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2
 ABORT PUMPDOWN             | T4:284.TT - ] [ - File #2 MAIN_PRGRM - 84
 BT_PD                                                             PUMP1E
    N7:17                                                          DISABLE
|---] [---------------------+                                      PULSE
     8                                                             PUMP1EDPLSE
 [3]                                                               TON
                                                                   TIMER ON DELAY  (EN)
 PIRANI                                                            TIMER:    T4:284
 GUAGE 1                                                           BASE (SEC):  1.0 (DN)
 NO FAULT                                                          PRESET:        5
 PGNF1                                                             ACCUM:         0
   I:004
|---]/[---------------------+
    14
 PREPARE FOR
 AUTO RUN
 >AUTO
   N7:37
|---] [---------------------+
    1
 [162]
Rung #438
            HEATER 2   DWELL 1    DWELL 2    HEATER 3
            CHAMBER    CHAMBER    CHAMBER    CHAMBER    PIRANI   SYSTEM
 PUMP AREA  GATE VALVE GATE VALVE GATE VALVE GATE VALVE GUAGE 2  VENT     VENT AREA   PUMP AREA
 2          CLOSE      CLOSED     CLOSED     CLOSED     NO FAULT ENABLE   2 ENABLE    2 ENABLE
 TS22       HV2S1      HV3S1      HV4S1      HV5S1      PGNF2    SYSVNTE  VENT2E      PUMP2E
  N7:16      I:004      I:004      I:022      I:024      I:004    N7:37    N7:37        N7:37
|--] [------] [------] [------] [------] [------] [------]/[------]/[--------------(L)---|
   14         00         03         06         00        15        5        7           14
 [3]                                                             [369]    [417]
N7:37/14 - ] [ - File #2 MAIN_PRGRM - 27,28,29,30,56,73,106,229,414,415,439,440,445
           ]/[ - File #2 MAIN_PRGRM - 369,411
          -(L)- - File #2 MAIN_PRGRM - 438
          -(U)- - File #2 MAIN_PRGRM - 441
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2
Rung #439
 PUMP AREA                                                         PUMP SECTION 2
 2 ENABLE                                                          TIMER
 PUMP2E                                                            PMP2TMR
  N7:37                                                            TON
|--] [-------------------------------------------------------------TIMER ON DELAY  (EN)
   14                                                              TIMER:    T4:262
 [438]                                                             BASE (SEC):  1.0 (DN)
                                                                   PRESET:      600
                                                                   ACCUM:         0
```

```
T4:262.DN - -| |- - File #2 MAIN_PRGR.    609
Rung #440
                                                                        DWELL 2
           ENABLE     ENABLE     ENABLE     ENABLE     DWELL 1          CHAMBER
           CRYO       CRYO       CRYO       CRYO       CHAMBER          ROUGH
PUMP AREA  COMPRESSOR COMPRESSOR COMPRESSOR COMPRESSOR VENT VALVE DOOR 3 DOOR 5 DOOR 4 VALVE RV2   PUMP2
2 ENABLE   2          3          4          5          CLOSED     CLOSED CLOSED OPEN   CLOSED      STAGE 1
PUMP2E     CY2        CY3        CY4        CY5        CVS3       DRCL3S DRCL5S DROP4S RVS3        P2ST1
 N7:37     O:010      O:030      O:030      O:044      I:002      I:006  I:026  I:006  I:022        83
--| |--------| |--------| |--------| |--------| |--------| |--------| |----| |----| |----| |--------( )--
   14         05         04         05         04         13         04     00     07     15         424
[441]      [27]       [28]       [29]       [30]
83/424 - -| |- - File #2 MAIN_PRGRM -  117,118,119,120,121,122,123,124,441
         -( )- - File #2 MAIN_PRGRM -  440
Rung #441
          HEATER 2   DWELL 1    DWELL 2    HEATER 3
          CHAMBER    CHAMBER    CHAMBER    CHAMBER                        PUMP AREA
 PUMP2    GATE VALVE GATE VALVE GATE VALVE GATE VALVE                     2 ENABLE
 STAGE 1  OPEN       OPEN       OPEN       OPEN                           PUMP2E
 P2ST1    HV2S3      HV3S3      HV4S3      HV5S3                            N7:37
  83      I:004      I:004      I:022      I:024
--| |--------| |--------| |--------| |--------| |----+---------------------+---(U)---+
  424        02         05         10         02    |                     |    14    |
 [440]                                              |                     |          |
                                                    |                     |PUMP 2    |
 ABORT PUMPDOWN                                     |                     |END PULSE |
 BT_PD                                              |                     |P2ENDPULSE|
    N7:17                                           |                     |+-TON-----------+
--------| |-----------------------------------------+                     +|TIMER ON DELAY |-(EN)-+
         8                                          |                      |TIMER:   T4:125|
 [3]                                                |                      |BASE (SEC): 1.0|-(DN)
                                                    |                      |PRESET:       5|
 PIRANI                                             |                      |ACCUM:        0|
 GUAGE 2                                            |                      +---------------+
 NO FAULT                                           |
 PGNF2                                              |
  I:004                                             |
--|/|-----------------------------------------------+
   15                                               |
 PREPARE FOR                                        |
 AUTO RUN                                           |
 >AUTO                                              |
   N7:37                                            |
-------| |------------------------------------------+
        1
 [162]
N7:37/14 - -| |- - File #2 MAIN_PRGRM -  27,28,29,30,56,73,106,229,414,415,439,440,445
           -|/|- - File #2 MAIN_PRGRM -  369,411
           -(L)- - File #2 MAIN_PRGRM -  438
           -(U)- - File #2 MAIN_PRGRM -  441
_F:N7:211X21 - BTW - File #2 MAIN_PRGRM -  2
T4:125.TT - -| |- - File #2 MAIN_PRGRM -  91
```

Rung #442

```
|          DWELL 3     DWELL 4     BUFFER 3
|          CHAMBER     CHAMBER     CHAMBER     PIRINI     SYSTEM
|PUMP AREA GATE VALVE  GATE VALVE  GATE VALVE  GUAGE 3    VENT     VENT AREA                PUMP AREA |
|3         CLOSED      CLOSED      CLOSED      NO FAULT   ENABLE   3 ENABLE                 3 ENABLE  |
|TS23      HV6S1       HV7S1       HV8S1       PGNF3      STSVNTE  VENT3E                   PUMP3E    |
|  N7:16     I:024      I:036       I:040       I:024      N7:37    N7:37                    N7:37    |
|---] [------] [--------] [---------] [---------] [--------]/[------]/[-----------------------(L)-----|
|   15        03         06          00          14          5        8                        15     |
|[3]                                                       [369]    [424]                             |
N7:37/15 - ] [ - File #2 MAIN_PRGRM -  30,31,57,73,107,420,422,443,444,445
           ]/[ - File #2 MAIN_PRGRM -  369,418
           -(L)- - File #2 MAIN_PRGRM -  442
           -(U)- - File #2 MAIN_PRGRM -  446
_F:N7:211X21 - BTW - File #2 MAIN_PRGRM -  2
```

Rung #443

```
|PUMP AREA                                                          PUMP SECTION 3             |
|3 ENABLE                                                           TIMER                      |
|PUMP3E                                                             PMP3TMR                    |
|  N7:37                                                            +-TON-------------+        |
|---] [-------------------------------------------------------------+TIMER ON DELAY   +-(EN)---|
|    15                                                             |TIMER:     T4:288|        |
|[442]                                                              |BASE (SEC):   1.0+-(DN)   |
|                                                                   |PRESET:       600|        |
|                                                                   |ACCUM:          0|        |
|                                                                   +-----------------+        |
T4:288.DN - ] [ - File #2 MAIN_PRGRM -  609
```

Rung #444

```
|                                                              DWELL 4                         |
|          ENABLE       ENABLE       DWELL 4                    CHAMBER                         |
|          CRYO         CRYO         CHAMBER                    ROUGH                           |
|PUMP AREA COMPRESSOR   COMPRESSOR   VENT VALVE  DOOR 6  DOOR 7  VALVE                  PUMP 3  |
|3 ENABLE  5            6            CLOSED      CLOSED  CLOSED  CLOSED                 STAGE 1 |
|PUMP3E    CY5          CY6          CVS5        DRCL6S  DRCL7S  RVS5                   P3ST1   |
|  N7:37     O:044        O:044        I:022     I:026   I:042    I:036                 B3      |
|---] [------] [----------] [----------] [--------] [-----] [------] [-------------------( )-----|
|    15        04           05           11         02      00       15                 426     |
|[442]      [30]         [31]                                                                  |
B3/426 - ] [ - File #2 MAIN_PRGRM -  125,126,127,128,129,130,446
       -( )- - File #2 MAIN_PRGRM -  444
```

Rung #445

```
| PUMP AREA    BLOWER 2                                          PUMP AREA
| 2 ENABLE     ENABLED                                           2, 3, & 4
| PUMP2E       BL2                                               RV TIMER
|   N7:37        O:027                                           P2-4RVTMR
|                                                                +-TON--------------+
+--+-] [---+----] [-------------------------------------------+-+TIMER ON DELAY    +-(EN)-
|  |  14   |     01                                             |TIMER:        T4:3|
|  |[441]  |   [93]                                             |BASE (SEC):    1.0+-(DN)
|  |       |                                                    |PRESET:          5|
|  |       |                                                    |ACCUM:           0|
|  |PUMP AREA                                                   +------------------+
|  |3 ENABLE |
|  |PUMP3E   |
|  |  N7:37  |
|  +---] [---+
|  |   15    |
|  |[446]    |
|  |PUMP AREA|
|  |4 ENABLE |
|  |PUMP4E   |
|  |  N7:38  |
|  +---] [---+
|       0
|  [447]
T4:3.DN - ] [ - File #2 MAIN_PRGRM - 56,57,58
```

Rung #446

```
|            DWELL 3      DWELL 4      BUFFER 3
|            CHAMBER      CHAMBER      CHAMBER
| PUMP 3     GATE VALVE   GATE VALVE   GATE VALVE                    PUMP AREA
| STAGE 1    OPEN         OPEN         OPEN                          3 ENABLE
| P3ST1      HV6S3        HV7S3        HV8S3                         PUMP3E
|   B3         I:024        I:036        I:040                         N7:37
+-+-] [-------] [-----------] [-----------] [---+----------------------+--(U)----+
| |  426        05           10            02   |                      |   15    |
| |[444]                                        |                      |         |
| |                                             | N7:37/15 - ] [ - File #2 MAIN_PRGRM - 30, 31,
| |                                             |       57, 73, 107, 420, 422, 443,
| |                                             |       444, 445       |PUMP 3   |
| |                                             |  -]/[- - File #2 MAIN_PRGRM - 369, 418
| |                                             |  -(L)- - File #2 MAIN_PRGRM - 442
| |ABORT PUMPDOWN                               | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2
| |BT_PD                                        | T4:126.TT - ] [ - File #2 MAIN_PRGRM - 91
| |    N7:17                                    |
| +-----] [-------------------------------------+
| |      8                                                           |PUMP 3
| |[3]                                                               |END PULSE
| |PIRINI                                                            |P3ENDPULSE
| |GUAGE 3                                                           |+-TON--------------+
| |NO FAULT                                                          ++TIMER ON DELAY    +-(EN)-
| |PGNF3                                                              |TIMER:      T4:126|
| |  I:024                                                            |BASE (SEC):    1.0+-(DN)
| +---]/[---------------------------------------+                     |PRESET:          5|
| |    14                                       |                     |ACCUM:           0|
| |PREPARE FOR                                  |                     +------------------+
| |AUTO RUN                                     |
| |>AUTO                                        |
| |   N7:37                                     |
| +-----] [-------------------------------------+
|        1
|  [162]
```

```
Rung #447
|                    DWELL 5      DWELL 6      BUFFER 4                                                                   |
|          PIRINI     CHAMBER      CHAMBER      CHAMBER      SYSTEM                                                        |
|PUMP AREA GUAGE 4   GATE VALVE   GATE VALVE   GATE VALVE   VENT       VENT AREA                               PUMP AREA   |
|4         NO FAULT  CLOSED       CLOSED       CLOSED       ENABLE     4 ENABLE                                4 ENABLE    |
|TS24      PGNF4     HV9S1        HV10S1       HV11S1       SYSVNTE    VENT4E                                  PUMP4E      |
|  N7:17    I:024     I:040        I:052        I:054        N7:37      N7:37                                     N7:38    |
|---] [------] [-------] [----------] [----------] [----------]/[--------]/[-------------------------------------(L)-----|
|    0        15        03           06           00           5          9                                        0     |
|[3]                                                        [369]      [429]                                             |
N7:38/0 - ] [ - File #2 MAIN_PRGRM -  32,33,58,73,108,427,445,448,449
          ]/[ - File #2 MAIN_PRGRM -  369,425
         -(L)- - File #2 MAIN_PRGRM -  447
         -(U)- - File #2 MAIN_PRGRM -  450
_F:N7:211X21 - BTW - File #2 MAIN_PRGRM -  2
Rung #448
|PUMP AREA                                                                       PUMP SECTION 4          |
|4 ENABLE                                                                        TIMER                   |
|PUMP4E                                                                          PMP4TMR                 |
|  N7:38                                                                         +--TON-----------+      |
|---] [--------------------------------------------------------------------------|TIMER ON DELAY  |-(EN)-|
|    0                                                                           |TIMER:   T4:295 |      |
|(447)                                                                           |BASE (SEC):  1.0|-(DN) |
|                                                                                |PRESET:      600|      |
|                                                                                |ACCUM:         0|      |
|                                                                                +----------------+      |
T4:295.DN - ] [ - File #2 MAIN_PRGRM -  609
Rung #449
|                                                               DWELL 5                                 |
|          ENABLE      ENABLE      DWELL 5                       CHAMBER                                 |
|          CRYO        CRYO        CHAMBER                       ROUGH                                   |
|PUMP AREA COMPRESSOR COMPRESSOR  VENT VALVE  DOOR 8   DOOR 9   VALVE                        PUMP 4      |
|4 ENABLE  7          8           CLOSED      CLOSED   CLOSED   CLOSED                       STAGE 1     |
|PUMP4E    CY7        CY8         CVS7        DRCL8S   CRCL9S   RVS7                         P4ST1       |
|  N7:38    O:060      O:060       I:036       I:042    I:056    I:052                        B3          |
|---] [------] [--------] [---------] [--------] [------] [------] [-------------------------( )---------|
|    0        04         05          11          02       00       14                         428        |
|[450]      [32]       [33]                                                                              |
B3/428 - ] [ - File #2 MAIN_PRGRM -  131,132,133,134,135,136,450
        -( )- - File #2 MAIN_PRGRM -  449
```

```
Rung #450
         DWELL 5     DWELL 6     BUFFER 4
         CHAMBER     CHAMBER     CHAMBER
PUMP 4   GATE VALVE  GATE VALVE  GATE VALVE                          PUMP AREA
STAGE 1  OPEN        OPEN        OPEN                                4 ENABLE
P4ST1    HV9S3       HV10S3      HV11S3                              PUMP4E
 B3       I:040       I:052       I:054                               N7:38
-] [--------] [-------] [--------] [---------------------------------(U)-
 428       05          10          02                                  0
[449]
                      N7:38/0 - ] [ - - File #2 MAIN_PRGRM - 32, 33, 58,
                                     73, 108, 427, 445, 448, 449
                             ]/[ - - File #2 MAIN_PRGRM - 369, 425      PUMP 4
                             -(L)- - File #2 MAIN_PRGRM - 447           END PULSE
                      _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2       P4ENDPULSE
ABORT PUMPDOWN        T4:127.TT - ] [ - - File #2 MAIN_PRGRM - 91       TON
BT_PD                                                   TIMER ON DELAY    -(EN)-
   N7:17                                                TIMER:    T4:127
---] [-----                                             BASE (SEC):  1.0 -(DN)
    8                                                   PRESET:      5
[3]                                                     ACCUM:       0

PIRINI
GUAGE 4
NO FAULT
PGNF4
  I:024
---]/[-----
   15
PREPARE FOR
AUTO RUN
>AUTO
   N7:37
---] [-----
    1
[162]

Rung #451
            EXITLOCK
            CHAMBER      SYSTEM
PUMP AREA   GATE VALVE   VENT     VENT AREA                           PUMP AREA
5           CLOSED       ENABLE   5 ENABLE                            5 ENABLE
TS25        HV12S1       SYSVNTE  VENT5E                              PUMP5E
 N7:17       I:054        N7:37    N7:37                               N7:38
---] [--------] [---------]/[------]/[-------------------------------(L)-
   1          03          5         10                                 1
[3]                      [369]     [433]
N7:38/1 - ] [ - - File #2 MAIN_PRGRM -  32,78,109,327,335,340,353,452,453,456
          ]/[ - - File #2 MAIN_PRGRM -  369,414,430
          -(L)- - File #2 MAIN_PRGRM -  451
          -(U)- - File #2 MAIN_PRGRM -  454
_F:N7:211X21 - BTW - File #2 MAIN_PRGRM -  2

Rung #452
PUMP AREA                                                  PUMP SECTION 5
5 ENABLE                                                   TIMER
PUMP5E                                                     PMP5TRM
  N7:38                                                    TON
---] [---------------------------------------------------- TIMER ON DELAY  -(EN)-
    1                                                      TIMER:    T4:296
[451]                                                      BASE (SEC):  1.0 -(DN)
                                                           PRESET:      600
                                                           ACCUM:       0
```

```
T4:296.DN - -| |- - File #2 MAIN_PRGRM   609
Rung #453
|              ENABLE      OPEN
|              CRYO        EXLOCK
|PUMP AREA     COMPRESSOR  CHAMBER     DOOR 10   DOOR 11   DOOR 12                  PUMP 5
|5 ENABLE      7           VENT VALVE  CLOSED    OPEN      CLOSED                   STAGE 1
|PUMP5E        CY7         CV5         DRCL10S   DROP11S   DRCL12S                  P5ST1
|  N7:38       O:060       O:057       I:056     I:056     I:056                    B3
|---| |--------| |---------|/|---------| |-------| |-------| |-----------------------( )---
|   1          04          16          02        05        06                       430
|[454]         [32]        [367]
B3/430 - -| |- - File #2 MAIN_PRGRM -  137,138,454
         -( )- - File #2 MAIN_PRGRM -  453
Rung #454
|                                                                          PUMP AREA
| ABORT PUMPDOWN                                                           5 ENABLE
| BT_PD                                                                    PUMP5E
|      N7:17                                                                 N7:38
|-+-----| |------+-----------------------------------------------------------+---(U)---+-
| |       8      |                                                           |     1   |
| |[3]           |                                                           |         |
| |              | N7:38/1 - -| |- - File #2 MAIN_PRGRM - 32, 78, 109, 327, 335, 340,
| |              |                  353, 452, 453, 456
| |       EXIT   |            -|/|- - File #2 MAIN_PRGRM - 369, 414, 430    |PUMP 5
| |       BUFFER |            -(L)- - File #2 MAIN_PRGRM - 451               |END PULSE
| |PUMP 5 GATE VALVE | _F:N7:211%21 - BTW - File #2 MAIN_PRGRM - 2         |P5ENDPULSE
| |STAGE 1 OPEN  | T4:128.TT - -| |- - File #2 MAIN_PRGRM - 98, 326        |+-TON-----------+
| |P5ST1  HV12S3 |                                                         +-|TIMER ON DELAY |-(EN)-
| |  B3     I:054|                                                           |TIMER:   T4:128|
| |---| |----| |-|                                                           |BASE (SEC): 1.0|-(DN)
| | 430      05  |                                                           |PRESET:       5|
| |[453]         |                                                           |ACCUM:        0|
| |              |                                                           +---------------+
| |PREPARE FOR   |
| |AUTO RUN      |
| |>AUTO         |
| |   N7:37      |
| +----| |-------+
|      1
| [162]
Rung #455
|PUMP AREA   BLOWER 1                                                        PUMP AREA
|1 ENABLE    ENABLED                                                         1 RV TIMER
|PUMP1E      BL1                                                             P1RVTMR
|  N7:37     O:007                                                           +-TON-----------+
|---| |-------| |------------------------------------------------------------|TIMER ON DELAY |-(EN)-
|   13        01                                                             |TIMER:     T4:2|
|[437]       [86]                                                            |BASE (SEC): 1.0|-(DN)
|                                                                            |PRESET:       5|
|                                                                            |ACCUM:        0|
|                                                                            +---------------+
T4:2.DN - -| |- - File #2 MAIN_PRGRM -  167
Rung #456
|PUMP AREA   BLOWER 3                                                        PUMP AREA
|5 ENABLE    ENABLED                                                         5 RV TIMER
|PUMP5E      BL3                                                             T5RVTMR
|  N7:38     O:057                                                           +-TON-----------+
|---| |-------| |------------------------------------------------------------|TIMER ON DELAY |-(EN)-
|   1         01                                                             |TIMER:     T4:4|
|[454]       [100]                                                           |BASE (SEC): 1.0|-(DN)
|                                                                            |PRESET:       5|
|                                                                            |ACCUM:        0|
|                                                                            +---------------+
```

```
T4:4.DN - -| |- - File #2 MAIN_PRGRM    340
Rung #457
|MANUAL
|CONTROL
|CRYO GATE                                                      MANUAL CRYO
|1 OPEN                                                         GATE 1 OPEN
|M-HV1-1                                                        MCG1OP
|  N7:4                                                            N7:25
|---| |-----------------------------------------------------+------(L)-----+-|
|    5                                                      |       5      | |
|[3]                                                        |              | |
| N7:25/5 - -| |- - File #2 MAIN_PRGRM - 115                 |              | |
|          -(U)- - File #2 MAIN_PRGRM - 458                  |MANUAL CRYO   | |
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2               |GATE 1 CLOSE  | |
| N7:26/12 - -(L)- - File #2 MAIN_PRGRM - 458               |MCG1CL        | |
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2               |   N7:26      | |
|                                                           +------(U)-----+ |
|                                                                   12       |
Rung #458
| MANUAL
| CONTROL
| CRYO GATE                                                     MANUAL CRYO
| 1 CLOSE                                                       GATE 1 OPEN
| M-HV1-0                                                       MCG1OP
|   N7:5                                                           N7:25
|-+----| |----+---------------------------------------------+------(U)-----+-|
| |    12     |                                             |       5      | |
| |[3]        |                                             |              | |
| |           | N7:25/5 - -| |- - File #2 MAIN_PRGRM - 115  |              | |
| |           |          -(L)- - File #2 MAIN_PRGRM - 457   |              | |
| |           | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2 |MANUAL CRYO   | |
| |           | N7:26/12 - -(U)- - File #2 MAIN_PRGRM - 457 |GATE 1 CLOSE  | |
| |PREPARE FOR| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2 |MCG1CL        | |
| |AUTO RUN   |                                             |   N7:26      | |
| |>AUTO      |                                             +------(L)-----+ |
| |   N7:37   |                                                     12       |
| |----| |----|                                                             |
| |     1     |                                                             |
| |[162]      |                                                             |
| |COMPRESSOR |                                                             |
| |1 REGEN-   |                                                             |
| |ERATION    |                                                             |
| |PROGRAM    |                                                             |
| |CYRGN1     |                                                             |
| |    B3     |                                                             |
| +----| |----+                                                             |
|     321                                                                   |
|  [3:0]                                                                    |
```

Rung #459

```
|MANUAL
|CONTROL
|CRYO GATE                                              MANUAL CRYO
|2 OPEN                                                 GATE 2 OPEN
|M-HV2-1                                                MCG2OP
|  N7:4                                                    N7:25
|---] [--------------------------------------------------+---(L)---+--
|   6                                                    |    6    |
|[3]                                                     |         |
| N7:25/6 - ] [ - File #2 MAIN_PRGRM - 117, 118, 462     |         |
|          -(U)- - File #2 MAIN_PRGRM - 460              |MANUAL CRYO
| _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2            |GATE 2 CLOSE
| N7:26/13 - -(L)- - File #2 MAIN_PRGRM - 460            |MCG2CL   |
| _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2            |   N7:26 |
|                                                        +---(U)---+
                                                              13
```

Rung #460

```
|  MANUAL
|  CONTROL
|  CRYO GATE                                            MANUAL CRYO
|  2 CLOSE                                              GATE 2 OPEN
|  M-HV2-0                                              MCG2OP
|     N7:5                                                 N7:25
|--+---] [----+------------------------------------------+---(U)---+--
|  |    13    |                                          |    6    |
|  |[3]       |                                          |         |
|  |          | N7:25/6 - ] [ - File #2 MAIN_PRGRM - 117, 118, 462 |
|  |          |           -(L)- - File #2 MAIN_PRGRM - 459         |
|  |MANUAL    | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2        |MANUAL CRYO
|  |CONTROL   | N7:26/13 - -(U)- - File #2 MAIN_PRGRM - 459        |GATE 2 CLOSE
|  |CRYO GATE | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2        |MCG2CL
|  |2 THROTTLE|                                          |   N7:26 |
|  |M-HV2-2   |                                          +---(L)---+
|  |   N7:5   |                                               13
|  +---] [----+
|  |    1     |
|  |[3]       |
|  |PREPARE FOR
|  |AUTO RUN  |
|  |>AUTO     |
|  |   N7:37  |
|  +---]/[----+
|  |    1     |
|  |[162]     |
|  |COMPRESSOR|
|  |2 REGEN-  |
|  |ERATION   |
|  |PROGRAM   |
|  |CYRGN2    |
|  |    B3    |
|  +---] [----+
|      322
|  [3:34]
```

Rung #461

```
|MANUAL
|CONTROL
|CRYO GATE                                                          MANUAL CRYO
|2 THROTTLE                                                         GATE 2 THROTTLE
|M-HV2-2                                                            MCG2TL
|    N7:5                                                                N7:26
|----] [--------------------------------------------------------------------(L)----
|     1                                                                   1
|[3]
N7:26/1 - ] [ - File #2 MAIN_PRGRM -  118,118
         -(L)- - File #2 MAIN_PRGRM -  461
         -(U)- - File #2 MAIN_PRGRM -  462
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM -  2
```

Rung #462

```
| MANUAL
| CONTROL
| CRYO GATE                                                         MANUAL CRYO
| 2 CLOSE                                                           GATE 2 THROTTLE
| M-HV2-0                                                           MCG2TL
|    N7:5                                                                N7:26
|-+----] [-----+----------------------------------------------------------(U)----
| |     13     |                                                          1
| |[3]         |
| |            | N7:26/1 - ] [ - File #2 MAIN_PRGRM - 118
| |            |          -(L)- - File #2 MAIN_PRGRM - 461
| |            | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2
| |MANUAL CRYO |
| |GATE 2 OPEN |
| |MCG2OP      |
| |    N7:25   |
| +----] [-----+
| |     6      |
| |[460]       |
| |PREPARE FOR |
| |AUTO RUN    |
| |>AUTO       |
| |    N7:37   |
| +----] [-----+
| |     1      |
| |[162]       |
| |COMPRESSOR  |
| |2 REGEN-    |
| |ERATION     |
| |PROGRAM     |
| |CYRGN2      |
| |    B3      |
| +----] [-----+
|      322
| [3:34]
```

Rung #463

```
|MANUAL                                                                              |
|CONTROL                                                                             |
|CRYO GATE                                                           MANUAL CRYO     |
|3 OPEN                                                              GATE 3 OPEN     |
|M-HV3-1                                                             MCG3OP          |
|  N7:4                                                                 N7:25        |
|---] [--------------------------------------------------------------+----(L)----+--|
|    7                                                               |     7     | |
|[3]                                                                 |           | |
| N7:25/7 - ] [ - File #2 MAIN_PRGRM - 119, 120, 466                 |           | |
|         -(U)- - File #2 MAIN_PRGRM - 464                           |MANUAL CRYO | |
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                        |GATE 3 CLOSE| |
| N7:26/14 - -(L)- - File #2 MAIN_PRGRM - 464                        |MCG3CL      | |
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                        |   N7:26    | |
|                                                                    +----(U)----+ |
                                                                           14        |
```

Rung #464

```
| MANUAL                                                                             |
| CONTROL                                                                            |
| CRYO GATE                                                          MANUAL CRYO     |
| 3 CLOSE                                                            GATE 3 OPEN     |
| M-HV3-0                                                            MCG3OP          |
|    N7:5                                                               N7:25        |
|-+---] [---+--------------------------------------------------------+----(U)----+--|
| |   14    |                                                        |     7     | |
| |[3]      |                                                        |           | |
| |         | N7:25/7 - ] [ - File #2 MAIN_PRGRM - 119, 120, 466     |           | |
| |         |          -(L)- - File #2 MAIN_PRGRM - 463              |           | |
| |MANUAL   | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2            |MANUAL CRYO | |
| |CONTROL  | N7:26/14 - -(U)- - File #2 MAIN_PRGRM - 463            |GATE 3 CLOSE| |
| |CRYO GATE| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2            |MCG3CL      | |
| |3 THROTTLE                                                        |   N7:26    | |
| |M-HV3-2  |                                                        +----(L)----+ |
| |   N7:5  |                                                              14      |
| +---] [---+                                                                    |
| |    2    |                                                                    |
| |[3]      |                                                                    |
| |PREPARE FOR                                                                   |
| |AUTO RUN |                                                                    |
| |>AUTO    |                                                                    |
| |   N7:37 |                                                                    |
| +---]/[---+                                                                    |
| |    1    |                                                                    |
| |[162]    |                                                                    |
| |COMPRESSOR                                                                    |
| |3 REGEN- |                                                                    |
| |ERATION  |                                                                    |
| |PROGRAM  |                                                                    |
| |CYRGN3   |                                                                    |
| |   B3    |                                                                    |
| +---] [---+                                                                    |
|     323                                                                        |
|  [3:38]                                                                        |
```

Rung #465

```
|MANUAL                                                              MANUAL CRYO |
|CONTROL                                                             GATE 3      |
|CRYO GATE                                                           THROTTLE    |
|3 THROTTLE                                                          MCG3TL      |
|M-HV3-2                                                                N7:26    |
|   N7:5                                                                         |
|----| |---------------------------------------------------------------(L)------|
|    2                                                                   2       |
|[3]
N7:26/2 - -| |- - File #2 MAIN_PRGRM -  120,120
          -(L)- - File #2 MAIN_PRGRM -  465
          -(U)- - File #2 MAIN_PRGRM -  466
_F:N7:21[X21 - BTW - File #2 MAIN_PRGRM -  2
```

Rung #466

```
| MANUAL                                                             MANUAL CRYO |
| CONTROL                                                            GATE 3      |
| CRYO GATE                                                          THROTTLE    |
| 3 CLOSE                                                            MCG3TL      |
| M-HV3-0                                                               N7:26    |
|    N7:5                                                                        |
|-+----| |----+-------------------------------------------------------(U)------|
| |     14    |                                                          2       |
| |[3]        |                                                                  |
| |           | N7:26/2 - -| |- - File #2 MAIN_PRGRM - 120                      |
| |           |           -(L)- - File #2 MAIN_PRGRM - 465                      |
| |           | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                      |
| |MANUAL CRYO|                                                                  |
| |GATE 3 OPEN|                                                                  |
| |MCG3OP     |                                                                  |
| |   N7:25   |                                                                  |
| |----| |----|                                                                  |
| |     7     |                                                                  |
| |[464]      |                                                                  |
| |PREPARE FOR|                                                                  |
| |AUTO RUN   |                                                                  |
| |>AUTO      |                                                                  |
| |   N7:37   |                                                                  |
| |----| |----|                                                                  |
| |     1     |                                                                  |
| |[162]      |                                                                  |
| |COMPRESSOR |                                                                  |
| |3 REGEN-   |                                                                  |
| |ERATION    |                                                                  |
| |PROGRAM    |                                                                  |
| |CYRGN3     |                                                                  |
| |    B3     |                                                                  |
| +----| |----+                                                                  |
|     323                                                                        |
|  [3:38]                                                                        |
```

```
Rung #467
|MANUAL
|CONTROL
|CRYO GATE                                                              MANUAL CRYO
|4 OPEN                                                                 GATE 4 OPEN
|M-HV4-1                                                                MCG4OP
|   N7:4                                                                   N7:25
|---| |---------------------------------------------------------------+----(L)----+-|
|    8                                                                |     8     | |
|[3]                                                                  |           | |
| N7:25/8 - -| |- - File #2 MAIN_PRGRM - 121, 122, 470                |           | |
|           -(U)- - File #2 MAIN_PRGRM - 468                          |MANUAL CRYO| |
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                         |GATE 4 CLOSE |
| N7:26/15 - -(L)- - File #2 MAIN_PRGRM - 468                         |MCG4CL     | |
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                         |   N7:26   | |
|                                                                     +----(U)----+ |
|                                                                           15        |
Rung #468
| MANUAL
| CONTROL
| CRYO GATE                                                             MANUAL CRYO
| 4 CLOSE                                                               GATE 4 OPEN
| M-HV4-0                                                               MCG4OP
|    N7:5                                                                  N7:25
|-+---| |---+---------------------------------------------------------+----(U)----+-|
| |    15   |                                                         |     8     | |
| |[3]      |                                                         |           | |
| |         | N7:25/8 - -| |- - File #2 MAIN_PRGRM - 121, 122, 470    |           | |
| |         |           -(L)- - File #2 MAIN_PRGRM - 467              |           | |
| |MANUAL   | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2               |MANUAL CRYO| |
| |CONTROL  | N7:26/15 - -(U)- - File #2 MAIN_PRGRM - 467               |GATE 4 CLOSE |
| |CRYO GATE| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2               |MCG4CL     | |
| |4 THROTTLE                                                         |   N7:26   | |
| |M-HV4-2  |                                                         +----(L)----+ |
| |   N7:5  |                                                               15      |
| +---| |---+                                                                       |
| |    3    |                                                                       |
| |[3]      |                                                                       |
| |PREPARE FOR                                                                      |
| |AUTO RUN |                                                                       |
| |>AUTO    |                                                                       |
| |   N7:37 |                                                                       |
| +---| |---+                                                                       |
| |    1    |                                                                       |
| |[162]    |                                                                       |
| |COMPRESSOR                                                                       |
| |5 REGEN- |                                                                       |
| |ERATION  |                                                                       |
| |PROGRAM  |                                                                       |
| |CYRGN5   |                                                                       |
| |    B3   |                                                                       |
| +---| |---+                                                                       |
|    325                                                                            |
|  [3:46]                                                                           |
```

Rung #469

```
|MANUAL                                                              MANUAL CRYO |
|CONTROL                                                             GATE 4      |
|CRYO GATE                                                           THROTTLE    |
|4 THROTTLE                                                          MCG4TL      |
|M-HV4-2                                                                 N7:26   |
|    N7:5                                                                        |
|----] [-----------------------------------------------------------------(L)-----|
|     3                                                                   3      |
|[3]
N7:26/3 - ] [ - File #2 MAIN_PRGRM -  122,122
          -(L)- - File #2 MAIN_PRGRM -  469
          -(U)- - File #2 MAIN_PRGRM -  470
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM -  2
```

Rung #470

```
|  MANUAL                                                            MANUAL CRYO |
|  CONTROL                                                           GATE 4      |
|  CRYO GATE                                                         THROTTLE    |
|  4 CLOSE                                                           MCG4TL      |
|  M-HV4-0                                                               N7:26   |
|     N7:5                                                                        |
|-+-----] [----+---------------------------------------------------------(U)-----|
| |      15    |                                                          3      |
| |[3]         |                                                                 |
| |            | N7:26/3 - ] [ - File #2 MAIN_PRGRM - 122                        |
| |            |           -(L)- - File #2 MAIN_PRGRM - 469                      |
| |            | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                       |
| |MANUAL CRYO |                                                                 |
| |GATE 4 OPEN |                                                                 |
| |MCG4OP      |                                                                 |
| |    N7:25   |                                                                 |
| |-----] [----|                                                                 |
| |       8    |                                                                 |
| |[468]       |                                                                 |
| |PREPARE FOR |                                                                 |
| |AUTO RUN    |                                                                 |
| |>AUTO       |                                                                 |
| |    N7:37   |                                                                 |
| |-----] [----|                                                                 |
| |       1    |                                                                 |
| |[162]       |                                                                 |
| |COMPRESSOR  |                                                                 |
| |4 REGEN-    |                                                                 |
| |ERATION     |                                                                 |
| |PROGRAM     |                                                                 |
| |CYRGN4      |                                                                 |
| |      B3    |                                                                 |
| +-----] [----+                                                                 |
|       324                                                                      |
|  [3:42]                                                                        |
```

```
Rung #471
|MANUAL
|CONTROL
|CRYO GATE                                                      MANUAL CRYO
|5 OPEN                                                         GATE 5 OPEN
|M-HV5-1                                                        MCG5OP
|  N7:4                                                            N7:25
|---] [------------------------------------------------------+------(L)------+-
|   9                                                        |       9       |
|[3]                                                         |               |
| N7:25/9 - ] [ - File #2 MAIN_PRGRM - 123, 124, 474         |               |
|         -(U)- - File #2 MAIN_PRGRM - 472                   |MANUAL CRYO    |
| _F:N7:21I%21 - BTW - File #2 MAIN_PRGRM - 2                |GATE 5 CLOSE   |
| N7:27/0 - -(L)- - File #2 MAIN_PRGRM - 472                 |MCG5CL         |
| _F:N7:21I%21 - BTW - File #2 MAIN_PRGRM - 2                |    N7:27      |
|                                                            +------(U)------+
|                                                                    0
Rung #472
| MANUAL
| CONTROL
| CRYO GATE                                                     MANUAL CRYO
| 5 CLOSE                                                       GATE 5 OPEN
| M-HV5-0                                                       MCG5OP
|    N7:6                                                          N7:25
|-+---] [---+------------------------------------------------+------(U)------+-
| |    0    |                                                |       9       |
| |[3]      |                                                |               |
| |         | N7:25/9 - ] [ - File #2 MAIN_PRGRM - 123, 124, 474             |
| |         |          -(L)- - File #2 MAIN_PRGRM - 471      |               |
| |MANUAL   | _F:N7:21I%21 - BTW - File #2 MAIN_PRGRM - 2    |MANUAL CRYO    |
| |CONTROL  | N7:27/0 - -(U)- - File #2 MAIN_PRGRM - 471     |GATE 5 CLOSE   |
| |CRYO GATE| _F:N7:21I%21 - BTW - File #2 MAIN_PRGRM - 2    |MCG5CL         |
| |5 THROTTLE                                              |    N7:27      |
| |M-HV5-2  |                                              +------(L)------+
| |   N7:5  |                                                      0
| |---] [---|
| |    4    |
| |[3]      |
| |PREPARE FOR
| |AUTO RUN |
| |>AUTO    |
| |   N7:37 |
| |---] [---|
| |    1    |
| |[162]    |
| |COMPRESSOR
| |4 REGEN- |
| |ERATION  |
| |PROGRAM  |
| |CYRGN4   |
| |   B3    |
| +---] [---+
|     324
|  [3:42]
```

Rung #473

```
|MANUAL                                                              MANUAL CRYO |
|CONTROL                                                             GATE 5      |
|CRYO GATE                                                           THROTTLE    |
|5 THROTTLE                                                          MCG5TL      |
|M-HVS-2                                                                N7:26    |
|    N7:5                                                                        |
|----] [-----------------------------------------------------------------(L)-----|
|     4                                                                   4      |
|[3]
N7:26/4 - ] [ - File #2 MAIN_PRGRM - 124,124
          -(L)- - File #2 MAIN_PRGRM - 473
          -(U)- - File #2 MAIN_PRGRM - 474
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2
```

Rung #474

```
| MANUAL                                                             MANUAL CRYO |
| CONTROL                                                            GATE 5      |
| CRYO GATE                                                          THROTTLE    |
| 5 CLOSE                                                            MCG5TL      |
| M-HVS-0                                                               N7:26    |
|     N7:6                                                                       |
|-+------] [---+---------------------------------------------------------(U)-----|
| |       0    |                                                          4      |
| |[3]         |                                                                 |
| |            | N7:26/4 - ] [ - File #2 MAIN_PRGRM - 124                        |
| |            |           -(L)- - File #2 MAIN_PRGRM - 473                      |
| |            | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                     |
| |MANUAL CRYO |                                                                 |
| |GATE 5 OPEN |                                                                 |
| |MCG5OP      |                                                                 |
| |    N7:25   |                                                                 |
| +----] [-----+                                                                 |
| |      9     |                                                                 |
| |[472]       |                                                                 |
| |PREPARE FOR |                                                                 |
| |AUTO RUN    |                                                                 |
| |>AUTO       |                                                                 |
| |    N7:37   |                                                                 |
| +----] [-----+                                                                 |
| |      1     |                                                                 |
| |[162]       |                                                                 |
| |COMPRESSOR  |                                                                 |
| |4 REGEN-    |                                                                 |
| |ERATION     |                                                                 |
| |PROGRAM     |                                                                 |
| |CYRGN4      |                                                                 |
| |     B3     |                                                                 |
| +----] [-----+                                                                 |
|       324                                                                      |
|   [3:42]                                                                       |
```

```
Rung #475
|MANUAL                                                                                   |
|CONTROL                                                                                  |
|CRYO GATE                                                              MANUAL CRYO       |
|6 OPEN                                                                 GATE 6 OPEN       |
|M-HV6-1                                                                MCG6OP            |
|  N7:4                                                                    N7:25          |
|---] [-------------------------------------------------------------------+----(L)----+---|
|    10                                                                 |     10      | |
|[3]                                                                    |             | |
| N7:25/10 - ] [ - File #2 MAIN_PRGRM - 125, 126, 478                   |             | |
|            -(U)- - File #2 MAIN_PRGRM - 476                           |MANUAL CRYO  | |
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                           |GATE 6 CLOSE | |
| N7:27/1 - -(L)- - File #2 MAIN_PRGRM - 476                            |MCG6CL       | |
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                           |  N7:27      | |
|                                                                       +----(U)------+ |
|                                                                             1           |
Rung #476
| MANUAL                                                                                  |
| CONTROL                                                                                 |
| CRYO GATE                                                             MANUAL CRYO       |
| 6 CLOSE                                                               GATE 6 OPEN       |
| M-HV6-0                                                               MCG6OP            |
|    N7:6                                                                  N7:25          |
|-+---] [------+---------------------------------------------------------+----(U)----+---|
| |      1     |                                                        |     10      | |
| |[3]         |                                                        |             | |
| |            | N7:25/10 - ] [ - File #2 MAIN_PRGRM - 125, 126, 478    |             | |
| |            |              -(L)- - File #2 MAIN_PRGRM - 475          |             | |
| |MANUAL      | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2            |MANUAL CRYO  | |
| |CONTROL     | N7:27/1 - -(U)- - File #2 MAIN_PRGRM - 475             |GATE 6 CLOSE | |
| |CRYO GATE   | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2            |MCG6CL       | |
| |6 THROTTLE  |                                                        |  N7:27      | |
| |M-HV6-2     |                                                        +----(L)------+ |
| |    N7:5    |                                                             1           |
| |---] [------|                                                                         |
| |  .  5      |                                                                         |
| |[3]         |                                                                         |
| |PREPARE FOR |                                                                         |
| |AUTO RUN    |                                                                         |
| |>AUTO       |                                                                         |
| |    N7:37   |                                                                         |
| |----] [-----|                                                                         |
| |      1     |                                                                         |
| |[162]       |                                                                         |
| |COMPRESSOR  |                                                                         |
| |5 REGEN-    |                                                                         |
| |ERATION     |                                                                         |
| |PROGRAM     |                                                                         |
| |CYRGN5      |                                                                         |
| |     B3     |                                                                         |
| +----] [-----+                                                                         |
|     325                                                                                 |
|  [3:46]                                                                                 |
```

Rung #477

```
|MANUAL
|CONTROL                                                                      MANUAL CRYO |
|CRYO GATE                                                                    GATE 6      |
|6 THROTTLE                                                                   THROTTLE    |
|M-HV6-2                                                                      MCG6TL      |
|    N7:5                                                                        N7:26    |
|----] [-------------------------------------------------------------------------(L)------|
|     5                                                                           5       |
|[3]                                                                                      |
N7:26/5 - ] [ - File #2 MAIN_PRGRM -  126,126
         -(L)- - File #2 MAIN_PRGRM -  477
         -(U)- - File #2 MAIN_PRGRM -  478
_F:N7:21[X21 - BTW - File #2 MAIN_PRGRM -  2
```

Rung #478

```
|  MANUAL                                                                                 |
|  CONTROL                                                                    MANUAL CRYO |
|  CRYO GATE                                                                  GATE 6      |
|  6 CLOSE                                                                    THROTTLE    |
|  M-HV6-0                                                                    MCG6TL      |
|     N7:6                                                                        N7:26    |
|-+-----] [-----+--------------------------------------------------------------(U)--------|
| |       6     |                                                                 5       |
| | [3]         |                                                                         |
| |             | N7:26/5 - ] [ - File #2 MAIN_PRGRM - 126                                |
| |             |          -(L)- - File #2 MAIN_PRGRM - 477                               |
| |             | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                             |
| |MANUAL CRYO  |                                                                         |
| |GATE 6 OPEN  |                                                                         |
| |MCG6OP       |                                                                         |
| |    N7:25    |                                                                         |
| |-----] [-----|                                                                         |
| |      10     |                                                                         |
| |[476]        |                                                                         |
| |PREPARE FOR  |                                                                         |
| |AUTO RUN     |                                                                         |
| |>AUTO        |                                                                         |
| |    N7:37    |                                                                         |
| |-----] [-----|                                                                         |
| |      1      |                                                                         |
| |[162]        |                                                                         |
| |COMPRESSOR   |                                                                         |
| |5 REGEN-     |                                                                         |
| |ERATION      |                                                                         |
| |PROGRAM      |                                                                         |
| |CYRGN5       |                                                                         |
| |     B3      |                                                                         |
| +-----] [-----+                                                                         |
|       325                                                                               |
|  [3:46]                                                                                 |
```

Rung #479

```
|MANUAL                                                                  |
|CONTROL                                                                 |
|CRYO GATE                                                 MANUAL CRYO   |
|7 OPEN                                                    GATE 7 OPEN   |
|M-HV7-1                                                   MCG7OP        |
|  N7:4                                                      N7:25       |
|---] [------------------------------------------------------+--(L)---+--|
|    11                                                      |   11   |  |
|[3]                                                         |        |  |
| N7:25/11 - ] [ - File #2 MAIN_PRGRM - 127, 128, 482        |        |  |
|        -(U)- - File #2 MAIN_PRGRM - 480                    |MANUAL CRYO |
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                |GATE 7 CLOSE|
| N7:27/2 - -(L)- - File #2 MAIN_PRGRM - 480                 |MCG7CL  |  |
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                |  N7:27 |  |
|                                                            +--(U)---+  |
|                                                                2        |
```

Rung #480

```
| MANUAL                                                                 |
| CONTROL                                                                |
| CRYO GATE                                                MANUAL CRYO   |
| 7 CLOSE                                                  GATE 7 OPEN   |
| M-HV7-0                                                  MCG7OP        |
|   N7:6                                                     N7:25       |
|-+---] [---+------------------------------------------------+--(U)---+--|
| |    2    |                                                |   11   |  |
| |[3]      |                                                |        |  |
| |         | N7:25/11 - ] [ - File #2 MAIN_PRGRM - 127, 128, 482     |  |
| |         |         -(L)- - File #2 MAIN_PRGRM - 479       |        |  |
| |MANUAL   | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2    |MANUAL CRYO |
| |CONTROL  | N7:27/2 - -(U)- - File #2 MAIN_PRGRM - 479     |GATE 7 CLOSE|
| |CRYO GATE| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2    |MCG7CL  |  |
| |7 THROTTLE                                                |  N7:27 |  |
| |M-HV7-2  |                                                +--(L)---+  |
| |  N7:5   |                                                    2       |
| +---] [---+                                                            |
| |    6    |                                                            |
| |[3]      |                                                            |
| |PREPARE FOR                                                           |
| |AUTO RUN |                                                            |
| |>AUTO    |                                                            |
| |  N7:37  |                                                            |
| +---] [---+                                                            |
| |    1    |                                                            |
| |[162]    |                                                            |
| |COMPRESSOR                                                            |
| |5 REGEN- |                                                            |
| |ERATION  |                                                            |
| |PROGRAM  |                                                            |
| |CYRGN5   |                                                            |
| |   B3    |                                                            |
| +---] [---+                                                            |
|    325                                                                 |
|  [3:46]                                                                |
```

Rung #481

```
|MANUAL
|CONTROL                                                        MANUAL CRYO |
|CRYO GATE                                                      GATE 7      |
|7 THROTTLE                                                     THROTTLE    |
|M-HV7-2                                                        MCG7TL      |
|   N7:5                                                           N7:26    |
|----] [-------------------------------------------------------------(L)----|
|     6                                                              6      |
|[3]
N7:26/6 - ] [ - File #2 MAIN_PRGRM -  128,128
         -(L)- - File #2 MAIN_PRGRM -  481
         -(U)- - File #2 MAIN_PRGRM -  482
_F:N7:21 1%21 - BTW - File #2 MAIN_PRGRM - 2
```

Rung #482

```
| MANUAL                                                                    |
| CONTROL                                                       MANUAL CRYO |
| CRYO GATE                                                     GATE 7      |
| 7 CLOSE                                                       THROTTLE    |
| M-HV7-0                                                       MCG7TL      |
|    N7:6                                                          N7:26    |
|-+----] [-----+-----------------------------------------------------(U)----|
| |     2      |                                                     6      |
| |[3]         |                                                            |
| |            | N7:26/6 - ] [ - File #2 MAIN_PRGRM - 128                   |
| |            |          -(L)- - File #2 MAIN_PRGRM - 481                  |
| |            | _F:N7:21 1%21 - BTW - File #2 MAIN_PRGRM - 2               |
| |MANUAL CRYO |                                                            |
| |GATE 7 OPEN |                                                            |
| |MCG7OP      |                                                            |
| |   N7:25    |                                                            |
| +----] [-----+                                                            |
| |     11     |                                                            |
| |[480]       |                                                            |
| |PREPARE FOR |                                                            |
| |AUTO RUN    |                                                            |
| |>AUTO       |                                                            |
| |   N7:37    |                                                            |
| +----] [-----+                                                            |
| |     1      |                                                            |
| |[162]       |                                                            |
| |COMPRESSOR  |                                                            |
| |5 REGEN-    |                                                            |
| |ERATION     |                                                            |
| |PROGRAM     |                                                            |
| |CYRGN5      |                                                            |
| |    B3      |                                                            |
| +----] [-----+                                                            |
|     325                                                                   |
|  [3:46]                                                                   |
```

```
Rung #483
|MANUAL
|CONTROL
|CRYO GATE                                                             MANUAL CRYO
|8 OPEN                                                                GATE 8 OPEN
|M-HV8-1                                                               MCG8OP
|   N7:4                                                                 N7:25
|---] [-----------------------------------------------------------+------(L)-----+-
|   12                                                            |       12     |
|[3]                                                              |              |
| N7:25/12 - ] [ - - File #2 MAIN_PRGRM - 129, 130, 486           |              |
|           -(U)- - File #2 MAIN_PRGRM - 484                      |MANUAL CRYO   |
| _F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2                     |GATE 8 CLOSE  |
| N7:27/3 - -(L)- - File #2 MAIN_PRGRM - 484                      |MCG8CL        |
| _F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2                     |   N7:27      |
|                                                                 +------(U)-----+
                                                                          3
Rung #484
| MANUAL
| CONTROL
| CRYO GATE                                                            MANUAL CRYO
| 8 CLOSE                                                              GATE 8 OPEN
| M-HV8-0                                                              MCG8OP
|     N7:6                                                               N7:25
|-+---] [------+----------------------------------------------------+-----(U)-----+-
| |     3      |                                                    |      12     |
| |[3]         |                                                    |             |
| |            | N7:25/12 - ] [ - - File #2 MAIN_PRGRM - 129, 130, 486             |
| |            |          -(L)- - File #2 MAIN_PRGRM - 483          |             |
| |MANUAL      | _F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2        |MANUAL CRYO  |
| |CONTROL     | N7:27/3 - -(U)- - File #2 MAIN_PRGRM - 483         |GATE 8 CLOSE |
| |CRYO GATE   | _F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2        |MCG8CL       |
| |8 THROTTLE  |                                                    |   N7:27     |
| |M-HV8-2     |                                                    +-----(L)-----+
| |    N7:5    |                                                           3
| +----] [-----+
| |     7      |
| |[3]         |
| |PREPARE FOR |
| |AUTO RUN    |
| |>AUTO       |
| |    N7:37   |
| +----] [-----+
| |     1      |
| |[162]       |
| |COMPRESSOR  |
| |6 REGEN-    |
| |ERATION     |
| |PROGRAM     |
| |CYRGN6      |
| |     B3     |
| +----] [-----+
|      326
|  [3:52]
```

```
Rung #485
|MANUAL                                                          MANUAL CRYO |
|CONTROL                                                         GATE 8      |
|CRYO GATE                                                       THROTTLE    |
|8 THROTTLE                                                      MCG8TL      |
|M-HV8-2                                                           N7:26     |
|    N7:5                                                                    |
|----] [----------------------------------------------------------(L)-------|
|     7                                                              7       |
|[3]
N7:26/7 - ] [ - File #2 MAIN_PRGRM -  130,130
          -(L)- - File #2 MAIN_PRGRM -  485
          -(U)- - File #2 MAIN_PRGRM -  486
_F:N7:21[X21 - BTW - File #2 MAIN_PRGRM -  2
Rung #486
|  MANUAL                                                        MANUAL CRYO |
|  CONTROL                                                       GATE 8      |
|  CRYO GATE                                                     THROTTLE    |
|  8 CLOSE                                                       MCG8TL      |
|  M-HV8-0                                                         N7:26     |
|     N7:6                                                                    |
|-+----] [----+---------------------------------------------------(U)-------|
| |      3    |                                                     7       |
| |[3]        |                                                              |
| |           | N7:26/7 - ] [ - File #2 MAIN_PRGRM - 130                     |
| |           |           -(L)- - File #2 MAIN_PRGRM - 485                   |
| |           | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                  |
| |MANUAL CRYO|                                                              |
| |GATE 8 OPEN|                                                              |
| |MCG8OP     |                                                              |
| |   N7:25   |                                                              |
| |----] [----|                                                              |
| |     12    |                                                              |
| |[484]      |                                                              |
| |PREPARE FOR|                                                              |
| |AUTO RUN   |                                                              |
| |>AUTO      |                                                              |
| |   N7:37   |                                                              |
| |----] [----|                                                              |
| |     1     |                                                              |
| |[162]      |                                                              |
| |COMPRESSOR |                                                              |
| |6 REGEN-   |                                                              |
| |ERATION    |                                                              |
| |PROGRAM    |                                                              |
| |CYRGN6     |                                                              |
| |    B3     |                                                              |
| +----] [----+                                                              |
|      326                                                                   |
|  [3:52]                                                                    |
```

```
Rung #487
|MANUAL
|CONTROL
|CRYO GATE                                                                          MANUAL CRYO
|9 OPEN                                                                             GATE 9 OPEN
|M-HV9-1                                                                            MCG9OP
|  N7:4                                                                               N7:25
|---] [----------------------------------------------------------------------------+---(L)---+
|    13                                                                            |    13   |
|[3]                                                                               |         |
| N7:25/13 - ] [ - File #2 MAIN_PRGRM - 131, 132, 490                              |         |
|           -(U)- - File #2 MAIN_PRGRM - 488                                       |MANUAL CRYO
| _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                                      |GATE 9 CLOSE
| N7:27/4 - -(L)- - File #2 MAIN_PRGRM - 488                                       |MCG9CL
| _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                                      |   N7:27 |
|                                                                                  +---(U)---+
|                                                                                       4
Rung #488
|  MANUAL
|  CONTROL
|  CRYO GATE                                                                        MANUAL CRYO
|  9 CLOSE                                                                          GATE 9 OPEN
|  M-HV9-0                                                                          MCG9OP
|     N7:6                                                                            N7:25
|-+----] [----+--------------------------------------------------------------------+---(U)---+
| |     4     |                                                                    |    13   |
| |[3]        |                                                                    |         |
| |           | N7:25/13 - ] [ - File #2 MAIN_PRGRM - 131, 132, 490                |         |
| |           |            -(L)- - File #2 MAIN_PRGRM - 487                        |         |
| |MANUAL     | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                        |MANUAL CRYO
| |CONTROL    | N7:27/4 - -(U)- - File #2 MAIN_PRGRM - 487                         |GATE 9 CLOSE
| |CRYO GATE  | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                        |MCG9CL
| |9 THROTTLE |                                                                    |   N7:27 |
| |M-HV9-2    |                                                                    +---(L)---+
| |    N7:5   |                                                                         4
| +----] [----+
| |     8     |
| |[3]        |
| |PREPARE FOR|
| |AUTO RUN   |
| |>AUTO      |
| |    N7:37  |
| +----] [----+
| |     1     |
| |[162]      |
| |COMPRESSOR |
| |7 REGEN-   |
| |ERATION    |
| |PROGRAM    |
| |CYRGN7     |
| |     63    |
| +----] [----+
|     327
|  [3:57]
```

Rung #489

```
|MANUAL                                                                 MANUAL CRYO |
|CONTROL                                                                GATE 9      |
|CRYO GATE                                                              THROTTLE    |
|9 THROTTLE                                                             MCG9TL      |
|M-HV9-2                                                                   N7:26    |
|    N7:5                                                                           |
|----] [--------------------------------------------------------------------(L)-----|
|     8                                                                      8      |
|[3]
N7:26/8 - ] [ - File #2 MAIN_PRGRM -  132,132
          -(L)- - File #2 MAIN_PRGRM -  489
          -(U)- - File #2 MAIN_PRGRM -  490
_F:N7:21[X21 - BTW - File #2 MAIN_PRGRM -  2
```

Rung #490

```
| MANUAL                                                                MANUAL CRYO |
| CONTROL                                                               GATE 9      |
| CRYO GATE                                                             THROTTLE    |
| 9 CLOSE                                                               MCG9TL      |
| M-HV9-0                                                                  N7:26    |
|     N7:6                                                                          |
|--+----] [----+--------------------------------------------------------------(U)---|
|  |      4    |                                                           8        |
|  |[3]        |                                                                    |
|  |           | N7:26/8 - ] [ - File #2 MAIN_PRGRM - 132                           |
|  |           |           -(L)- - File #2 MAIN_PRGRM - 489                         |
|  |           | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                        |
|  |MANUAL CRYO|                                                                    |
|  |GATE 9 OPEN|                                                                    |
|  |MCG9OP     |                                                                    |
|  |   N7:25   |                                                                    |
|  |----] [----|                                                                    |
|  |     13    |                                                                    |
|  |[488]      |                                                                    |
|  |PREPARE FOR|                                                                    |
|  |AUTO RUN   |                                                                    |
|  |>AUTO      |                                                                    |
|  |   N7:37   |                                                                    |
|  |----] [----|                                                                    |
|  |     1     |                                                                    |
|  |[162]      |                                                                    |
|  |COMPRESSOR |                                                                    |
|  |7 REGEN-   |                                                                    |
|  |ERATION    |                                                                    |
|  |PROGRAM    |                                                                    |
|  |CYRGN7     |                                                                    |
|  |    B3     |                                                                    |
|  +----] [----+                                                                    |
|      327                                                                           |
|   [3:57]                                                                          |
```

Rung #582

```
|MOTOR 15                                                              MOTOR 15
|REVERSE                                                               REVERSE
|ENABLE                                                                M15R
|M15RE                                                                    B3
| N7:19
|---] [--------------------------------------------------------------+---(L)---+
|    14                                                              |   115   |
|[3]                                                                 |         |
|                                                                    |MANUAL   |
| B3/115 - ] [ - File #2 MAIN_PRGRM - 297                            |MOTOR 15 |
|          ]/[ - File #2 MAIN_PRGRM - 295                            |REVERSE  |
|          -(U)- - File #2 MAIN_PRGRM - 601                          |ENABLE   |
| N7:40/14 - -(U)- - File #2 MAIN_PRGRM - 601                        |MM15RE   |
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                        | N7:40   |
| N7:35/11 - -(L)- - File #2 MAIN_PRGRM - 601                        +---(L)---+
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                        |   14    |
|                                                                    |MANUAL   |
|                                                                    |MOTOR 15 |
|                                                                    |REVERSE  |
|                                                                    |DISABLE  |
|                                                                    |MM15RD   |
|                                                                    | N7:35   |
|                                                                    +---(U)---+
|                                                                        11
```

Rung #583

```
|MOTOR 16                                                              MOTOR 16
|REVERSE                                                               REVERSE
|ENABLE                                                                M16R
|M16RE                                                                    B3
| N7:19
|---] [--------------------------------------------------------------+---(L)---+
|    15                                                              |   116   |
|[3]                                                                 |         |
|                                                                    |MANUAL   |
| B3/116 - ] [ - File #2 MAIN_PRGRM - 306                            |MOTOR 16 |
|          ]/[ - File #2 MAIN_PRGRM - 306                            |REVERSE  |
|          -(U)- - File #2 MAIN_PRGRM - 602                          |ENABLE   |
| N7:40/15 - -(U)- - File #2 MAIN_PRGRM - 602                        |MM16RE   |
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                        | N7:40   |
| N7:35/12 - -(L)- - File #2 MAIN_PRGRM - 602                        +---(L)---+
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                        |   15    |
|                                                                    |MANUAL   |
|                                                                    |MOTOR 16 |
|                                                                    |REVERSE  |
|                                                                    |DISABLE  |
|                                                                    |MM16RD   |
|                                                                    | N7:35   |
|                                                                    +---(U)---+
|                                                                        12
```

```
Rung #584
|MOTOR 17                                                          MOTOR 17     |
|REVERSE                                                           REVERSE      |
|ENABLE                                                            M17R         |
|M17RE                                                                B3        |
|  N7:20                                                          ---(L)-------|
|---| |-------------------------------------------------------+-----------+    |
|     0                                                        |   117     |    |
|[3]                                                           |           |    |
|                                                              |MANUAL     |    |
| B3/117 - -| |- - File #2 MAIN_PRGRM - 312                     |MOTOR 17   |    |
|          -|/|- - File #2 MAIN_PRGRM - 310                     |REVERSE    |    |
|          -(U)- - File #2 MAIN_PRGRM - 603                     |ENABLE     |    |
| N7:41/0 - -(U)- - File #2 MAIN_PRGRM - 603                    |MM17RE     |    |
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                   |  N7:41    |    |
| N7:35/13 - -(L)- - File #2 MAIN_PRGRM - 603                   +---(L)-----+    |
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                   |    0      |    |
|                                                              |MANUAL     |    |
|                                                              |MOTOR 17   |    |
|                                                              |REVERSE    |    |
|                                                              |DISABLE    |    |
|                                                              |MM17RD     |    |
|                                                              |  N7:35    |    |
|                                                              +---(U)-----+    |
|                                                                   13          |

Rung #585
|MOTOR 18                                                          MOTOR 18     |
|REVERSE                                                           REVERSE      |
|ENABLE                                                            M18R         |
|M18RE                                                                B3        |
|  N7:20                                                          ---(L)-------|
|---| |-------------------------------------------------------+-----------+    |
|     1                                                        |   118     |    |
|[3]                                                           |           |    |
|                                                              |MANUAL     |    |
| B3/118 - -| |- - File #2 MAIN_PRGRM - 317                     |MOTOR 18   |    |
|          -|/|- - File #2 MAIN_PRGRM - 315                     |REVERSE    |    |
|          -(U)- - File #2 MAIN_PRGRM - 604                     |ENABLE     |    |
| N7:41/1 - -(U)- - File #2 MAIN_PRGRM - 604                    |MM18RE     |    |
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                   |  N7:41    |    |
| N7:35/14 - -(L)- - File #2 MAIN_PRGRM - 604                   +---(L)-----+    |
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                   |    1      |    |
|                                                              |MANUAL     |    |
|                                                              |MOTOR 18   |    |
|                                                              |REVERSE    |    |
|                                                              |DISABLE    |    |
|                                                              |MM18RD     |    |
|                                                              |  N7:35    |    |
|                                                              +---(U)-----+    |
|                                                                   14          |
```

Rung #586

```
|MOTOR 19                                                              MOTOR 19
|REVERSE                                                               REVERSE
|ENABLE                                                                M19R
|M19RE                                                                    B3
| N7:20                                                                 -(L)-
|-| |-                                                                   119
|  2                                                                 |MANUAL
|[3]                                                                 |MOTOR 19
|                                                                    |REVERSE
| B3/119 - -| |- - File #2 MAIN_PRGRM - 322                          |ENABLE
|          -|/|- - File #2 MAIN_PRGRM - 320                          |MM19RE
|          -(U)- - File #2 MAIN_PRGRM - 605                          | N7:41
| N7:41/2 - -(U)- - File #2 MAIN_PRGRM - 605                         |-(L)-
| _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                        |  2
| N7:35/15 - -(L)- - File #2 MAIN_PRGRM - 605                        |MANUAL
| _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                        |MOTOR 19
|                                                                    |REVERSE
|                                                                    |DISABLE
|                                                                    |MM19RD
|                                                                    | N7:35
|                                                                    |-(U)-
|                                                                       15
```

Rung #587

```
|MOTOR 20                                                              MOTOR 20
|REVERSE                                                               REVERSE
|ENABLE                                                                M20R
|M20RE                                                                    B3
| N7:20                                                                 -(L)-
|-| |-                                                                   120
|  3                                                                 |MANUAL
|[3]                                                                 |MOTOR 20
|                                                                    |REVERSE
| B3/120 - -| |- - File #2 MAIN_PRGRM - 333                          |ENABLE
|          -|/|- - File #2 MAIN_PRGRM - 331                          |MM20RE
|          -(U)- - File #2 MAIN_PRGRM - 606                          | N7:41
| N7:41/3 - -(U)- - File #2 MAIN_PRGRM - 606                         |-(L)-
| _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                        |  3
| N7:36/0 - -(L)- - File #2 MAIN_PRGRM - 606                         |MANUAL
| _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                        |MOTOR 20
|                                                                    |REVERSE
|                                                                    |DISABLE
|                                                                    |MM20RD
|                                                                    | N7:36
|                                                                    |-(U)-
|                                                                       0
```

Rung #588

```
|MOTOR 21                                                         MOTOR 21
|REVERSE                                                          REVERSE
|ENABLE                                                           M21R
|M21RE                                                              B3
| N7:20
|--| |----------------------------------------------------------------(L)--
|   4                                                                121
|[3]
|                                                                 MANUAL
| B3/121 - -| |- - File #2 MAIN_PRGRM - 357                       MOTOR 21
|          -|/|- - File #2 MAIN_PRGRM - 355                       REVERSE
|          -(U)- - File #2 MAIN_PRGRM - 607                       ENABLE
| N7:41/4 - -(U)- - File #2 MAIN_PRGRM - 607                      MM21_RE
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                       N7:41
| N7:36/1 - -(L)- - File #2 MAIN_PRGRM - 607                      --(L)--
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                         4
|                                                                 MANUAL
|                                                                 MOTOR 21
|                                                                 REVERSE
|                                                                 DISABLE
|                                                                 MM21RD
|                                                                   N7:36
|                                                                 --(U)--
|                                                                     1
```

Rung #589

```
| MOTOR 3                                                         MOTOR 3
| REVERSE                                                         REVERSE
| DISABLE                                                         M3R
| M3RD                                                              B3
|   N7:13
|----| |---------------------------------------------------------------(U)--
|      15                                                            103
| [3]
|                B3/103 - -| |- - File #2 MAIN_PRGRM - 187            MANUAL
|                        -|/|- - File #2 MAIN_PRGRM - 185             MOTOR 3
|                        -(L)- - File #2 MAIN_PRGRM - 570             REVERSE
|               N7:40/2 - -(L)- - File #2 MAIN_PRGRM - 570            ENABLE
| PREPARE FOR   _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2           MM3RE
| AUTO RUN      N7:34/15 - -(U)- - File #2 MAIN_PRGRM - 570             N7:40
| >AUTO         _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2           --(U)--
|    N7:37                                                              2
|------| |-----
|       1                                                           MANUAL
| [162]                                                             MOTOR 3
|                                                                   REVERSE
|                                                                   DISABLE
|                                                                   MM3RD
|                                                                     N7:34
|                                                                   --(L)--
|                                                                      15
```

```
Rung #590
| MOTOR 4                                                                          |
| REVERSE                                                             MOTOR 4      |
| DISABLE                                                             REVERSE      |
| M4RD                                                                M4R          |
|  N7:14                                                                B3         |
|---] [-----------------------------------------------------------------+---(U)---+-|
| |   0     |                                                           |   104   | |
| |[3]      |                                                           |         | |
| |         | B3/104 - ] [ - File #2 MAIN_PRGRM - 192                   |MANUAL   | |
| |         |          ]/[ - File #2 MAIN_PRGRM - 190                   |MOTOR 4  | |
| |         |          -(L)- - File #2 MAIN_PRGRM - 571                 |REVERSE  | |
| |         | N7:40/3 - -(L)- - File #2 MAIN_PRGRM - 571                |ENABLE   | |
| |PREPARE FOR | _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2            |MM4RE    | |
| |AUTO RUN  | N7:35/0 - -(U)- - File #2 MAIN_PRGRM - 571               |  N7:40  | |
| |>AUTO     | _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2              +---(U)---+ |
| |  N7:37   |                                                          |    3    | |
| +----] [---+                                                          |         | |
|        1                                                              |MANUAL   | |
|  [162]                                                                |MOTOR 4  | |
|                                                                       |REVERSE  | |
|                                                                       |DISABLE  | |
|                                                                       |MM4RD    | |
|                                                                       |  N7:35  | |
|                                                                       +---(L)---+ |
|                                                                            0      |
Rung #591
| MOTOR 5                                                                          |
| REVERSE                                                             MOTOR 5      |
| DISABLE                                                             REVERSE      |
| M5RD                                                                M5R          |
|  N7:14                                                                B3         |
|---] [-----------------------------------------------------------------+---(U)---+-|
| |   1     |                                                           |   105   | |
| |[3]      |                                                           |         | |
| |         | B3/105 - ] [ - File #2 MAIN_PRGRM - 197                   |MANUAL   | |
| |         |          ]/[ - File #2 MAIN_PRGRM - 195                   |MOTOR 5  | |
| |         |          -(L)- - File #2 MAIN_PRGRM - 572                 |REVERSE  | |
| |         | N7:40/4 - -(L)- - File #2 MAIN_PRGRM - 572                |ENABLE   | |
| |PREPARE FOR | _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2            |MM5RE    | |
| |AUTO RUN  | N7:35/1 - -(U)- - File #2 MAIN_PRGRM - 572               |  N7:40  | |
| |>AUTO     | _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2              +---(U)---+ |
| |  N7:37   |                                                          |    4    | |
| +----] [---+                                                          |         | |
|        1                                                              |MANUAL   | |
|  [162]                                                                |MOTOR 5  | |
|                                                                       |REVERSE  | |
|                                                                       |DISABLE  | |
|                                                                       |MM5RD    | |
|                                                                       |  N7:35  | |
|                                                                       +---(L)---+ |
|                                                                            1      |
```

```
Rung #592
| MOTOR 6                                                              MOTOR 6
| REVERSE                                                              REVERSE
| DISABLE                                                              M6R
| M6RD                                                                 B3
|   N7:14                                                              
|---] [----------------------------------------------------------------+--(U)--+
|  |  2   |                                                            |  106  |
|  |[3]   |                                                            |       |
|  |      | B3/106 - -] [- - File #2 MAIN_PRGRM - 220                  |MANUAL |
|  |      |          -]/[- - File #2 MAIN_PRGRM - 218                  |MOTOR 6|
|  |      |          -(L)- - File #2 MAIN_PRGRM - 573                  |REVERSE|
|  |      | N7:40/5 - -(L)- - File #2 MAIN_PRGRM - 573                 |ENABLE |
|  |PREPARE FOR | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2          |MM6RE  |
|  |AUTO RUN    | N7:35/2 - -(U)- - File #2 MAIN_PRGRM - 573           | N7:40 |
|  |>AUTO       | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2          +--(U)--+
|  |   N7:37    |                                                      |   5   |
|  +----] [-----+                                                      |       |
|        1                                                              |MANUAL |
|  [162]                                                               |MOTOR 6|
|                                                                      |REVERSE|
|                                                                      |DISABLE|
|                                                                      |MM6RD  |
|                                                                      | N7:35 |
|                                                                      +--(L)--+
|                                                                          2
Rung #593
| MOTOR 7                                                              MOTOR 7
| REVERSE                                                              REVERSE
| DISABLE                                                              M7R
| M7RD                                                                 B3
|   N7:14
|---] [----------------------------------------------------------------+--(U)--+
|  |  3   |                                                            |  107  |
|  |[3]   |                                                            |       |
|  |      | B3/107 - -] [- - File #2 MAIN_PRGRM - 233                  |MANUAL |
|  |      |          -]/[- - File #2 MAIN_PRGRM - 231                  |MOTOR 7|
|  |      |          -(L)- - File #2 MAIN_PRGRM - 574                  |REVERSE|
|  |      | N7:40/6 - -(L)- - File #2 MAIN_PRGRM - 574                 |ENABLE |
|  |PREPARE FOR | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2          |MM7RE  |
|  |AUTO RUN    | N7:35/3 - -(U)- - File #2 MAIN_PRGRM - 574           | N7:40 |
|  |>AUTO       | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2          +--(U)--+
|  |   N7:37    |                                                      |   6   |
|  +----] [-----+                                                      |       |
|        1                                                              |MANUAL |
|  [162]                                                               |MOTOR 7|
|                                                                      |REVERSE|
|                                                                      |DISABLE|
|                                                                      |MM7RD  |
|                                                                      | N7:35 |
|                                                                      +--(L)--+
|                                                                          3
```

```
Rung #594
| MOTOR 8                                                              MOTOR 8
| REVERSE                                                              REVERSE
| DISABLE                                                              M8R
| M8RD                                                                   B3
|  N7:14
|---] [------------------------------------------------------------------(U)---
|     4                                                                  108
| [3]
|              B3/108 - ] [ - File #2 MAIN_PRGRM - 249                 MANUAL
|                       ]/[ - File #2 MAIN_PRGRM - 249                 MOTOR 8
|                       -(L)- - File #2 MAIN_PRGRM - 575               REVERSE
|              N7:40/7 - -(L)- - File #2 MAIN_PRGRM - 575              ENABLE
| PREPARE FOR  _F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2             MM8RE
| AUTO RUN     N7:35/4 - -(U)- - File #2 MAIN_PRGRM - 575               N7:40
| >AUTO        _F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2             ---(U)---
|    N7:37                                                                 7
|----] [----
|      1                                                               MANUAL
| [162]                                                                MOTOR 8
|                                                                      REVERSE
|                                                                      DISABLE
|                                                                      MM8RD
|                                                                       N7:35
|                                                                      ---(L)---
|                                                                          4

Rung #595
| MOTOR 9                                                              MOTOR 9
| REVERSE                                                              REVERSE
| DISABLE                                                              M9R
| M9RD                                                                   B3
|  N7:14
|---] [------------------------------------------------------------------(U)---
|     5                                                                  109
| [3]
|              B3/109 - ] [ - File #2 MAIN_PRGRM - 255                 MANUAL
|                       ]/[ - File #2 MAIN_PRGRM - 253                 MOTOR 9
|                       -(L)- - File #2 MAIN_PRGRM - 576               REVERSE
|              N7:40/8 - -(L)- - File #2 MAIN_PRGRM - 576              ENABLE
| PREPARE FOR  _F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2             MM9RE
| AUTO RUN     N7:35/5 - -(U)- - File #2 MAIN_PRGRM - 576               N7:40
| >AUTO        _F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2             ---(U)---
|    N7:37                                                                 8
|----] [----
|      1                                                               MANUAL
| [162]                                                                MOTOR 9
|                                                                      REVERSE
|                                                                      DISABLE
|                                                                      MM9RD
|                                                                       N7:35
|                                                                      ---(L)---
|                                                                          5
```

```
Rung #596
| MOTOR 10                                                                                  |
| REVERSE                                                                        MOTOR 10   |
| DISABLE                                                                        REVERSE    |
| M10RD                                                                          M10R       |
|   N7:14                                                                          B3       |
|---] [----------------------------------------------------------------------------(U)-----|
| |   6     |                                                                    | 110    | |
| |[3]      |                                                                    |        | |
| |         | B3/110 - ] [ - File #2 MAIN_PRGRM - 260                            |MANUAL  | |
| |         |          ]/[ - File #2 MAIN_PRGRM - 258                            |MOTOR 10| |
| |         |          -(L)- - File #2 MAIN_PRGRM - 577                          |REVERSE | |
| |         | N7:40/9 - -(L)- - File #2 MAIN_PRGRM - 577                         |ENABLE  | |
| |PREPARE FOR | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                     |MM10RE  | |
| |AUTO RUN | N7:35/6 - -(L)- - File #2 MAIN_PRGRM - 577                         | N7:40  | |
| |>AUTO    | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                        |--(U)---| |
| |  N7:37  |                                                                    |   9    | |
| |---] [---|                                                                    |        | |
|      1                                                                         |MANUAL  | |
| [162]                                                                          |MOTOR 10| |
|                                                                                |REVERSE | |
|                                                                                |DISABLE | |
|                                                                                |MM10RD  | |
|                                                                                | N7:35  | |
|                                                                                |--(L)---| |
|                                                                                    6       |
Rung #597
 MOTOR 11                                                                                   |
| REVERSE                                                                        MOTOR 11   |
| DISABLE                                                                        REVERSE    |
| M11RD                                                                          M11R       |
|   N7:14                                                                          B3       |
|---] [----------------------------------------------------------------------------(U)-----|
| |   7     |                                                                    | 111    | |
| |[3]      |                                                                    |        | |
| |         | B3/111 - ] [ - File #2 MAIN_PRGRM - 265                            |MANUAL  | |
| |         |          ]/[ - File #2 MAIN_PRGRM - 263                            |MOTOR 11| |
| |         |          -(L)- - File #2 MAIN_PRGRM - 578                          |REVERSE | |
| |         | N7:40/10 - -(L)- - File #2 MAIN_PRGRM - 578                        |ENABLE  | |
| |PREPARE FOR | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                     |MM11RE  | |
| |AUTO RUN | N7:35/7 - -(U)- - File #2 MAIN_PRGRM - 578                         | N7:40  | |
| |>AUTO    | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                        |--(U)---| |
| |  N7:37  |                                                                    |  10    | |
| |---] [---|                                                                    |        | |
|      1                                                                         |MANUAL  | |
| [162]                                                                          |MOTOR 11| |
|                                                                                |REVERSE | |
|                                                                                |DISABLE | |
|                                                                                |MM11RD  | |
|                                                                                | N7:35  | |
|                                                                                |--(L)---| |
|                                                                                    7       |
```

Rung #598

```
| MOTOR 12                                                              |
| REVERSE                                                    MOTOR 12   |
| DISABLE                                                    REVERSE    |
| M12RD                                                      M12R       |
|   N7:14                                                       B3      |
|-+---| |-----+------------------------------------------------+--(U)---+-|
| |     8     |                                                |  112   | |
| |[3]        |                                                |        | |
| |           | B3/112 - -| |- - File #2 MAIN_PRGRM - 281     |MANUAL  | |
| |           |          -|/|- - File #2 MAIN_PRGRM - 281     |MOTOR 12| |
| |           |          -(L)- - File #2 MAIN_PRGRM - 579     |REVERSE | |
| |           | N7:40/11 - -(L)- - File #2 MAIN_PRGRM - 579   |ENABLE  | |
| |PREPARE FOR| _F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2   |MM12RE  | |
| |AUTO RUN   | N7:35/8 - -(U)- - File #2 MAIN_PRGRM - 579    | N7:40  | |
| |>AUTO      | _F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2   +--(U)---+ |
| |  N7:37    |                                                |  11    | |
| +---| |-----+                                                |        | |
|     1                                                        |MANUAL  | |
| [162]                                                        |MOTOR 12| |
|                                                              |REVERSE | |
|                                                              |DISABLE | |
|                                                              |MM12RD  | |
|                                                              | N7:35  | |
|                                                              +--(L)---+ |
|                                                                  8      |
```

Rung #599

```
 MOTOR 13                                                               |
| REVERSE                                                    MOTOR 13   |
| DISABLE                                                    REVERSE    |
| M13RD                                                      M13R       |
|   N7:14                                                       B3      |
|-+---| |-----+------------------------------------------------+--(U)---+-|
| |     9     |                                                |  113   | |
| |[3]        |                                                |        | |
| |           | B3/113 - -| |- - File #2 MAIN_PRGRM - 287     |MANUAL  | |
| |           |          -|/|- - File #2 MAIN_PRGRM - 285     |MOTOR 13| |
| |           |          -(L)- - File #2 MAIN_PRGRM - 580     |REVERSE | |
| |           | N7:40/12 - -(L)- - File #2 MAIN_PRGRM - 580   |ENABLE  | |
| |PREPARE FOR| _F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2   |MM13RE  | |
| |AUTO RUN   | N7:35/9 - -(U)- - File #2 MAIN_PRGRM - 580    | N7:40  | |
| |>AUTO      | _F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2   +--(U)---+ |
| |  N7:37    |                                                |  12    | |
| +---| |-----+                                                |        | |
|     1                                                        |MANUAL  | |
| [162]                                                        |MOTOR 13| |
|                                                              |REVERSE | |
|                                                              |DISABLE | |
|                                                              |MM13RD  | |
|                                                              | N7:35  | |
|                                                              +--(L)---+ |
|                                                                  9      |
```

```
Rung #600
| MOTOR 14                                                                        MOTOR 14     |
| REVERSE                                                                         REVERSE      |
| DISABLE                                                                         M14R         |
| M14RD                                                                              B3        |
|   N7:14                                                                                      |
|----| |-----------------------------------------------------------------------------(U)------|
| |   10     |                                                                  |  114     |  |
| |[3]       |                                                                  |          |  |
| |          | B3/114 - -| |- - File #2 MAIN_PRGRM - 292                          |MANUAL    |  |
| |          |          -|/|- - File #2 MAIN_PRGRM - 290                          |MOTOR 14  |  |
| |          |          -(L)- - File #2 MAIN_PRGRM - 581                          |REVERSE   |  |
| |          | N7:40/13 - -(L)- - File #2 MAIN_PRGRM - 581                        |ENABLE    |  |
| |PREPARE FOR| _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                       |MM14RE    |  |
| |AUTO RUN  | N7:35/10 - -(U)- - File #2 MAIN_PRGRM - 581                        |  N7:40   |  |
| |>AUTO     | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                        |---(U)----|  |
| |   N7:37  |                                                                  |   13     |  |
| |----| |---|                                                                  |          |  |
|       1                                                                       |MANUAL    |  |
| [162]                                                                         |MOTOR 14  |  |
|                                                                               |REVERSE   |  |
|                                                                               |DISABLE   |  |
|                                                                               |MM14RD    |  |
|                                                                               |  N7:35   |  |
|                                                                               |---(L)----|  |
|                                                                                   10         |

Rung #601
  MOTOR 15                                                                        MOTOR 15     |
| REVERSE                                                                         REVERSE      |
| DISABLE                                                                         M15R         |
| M15RD                                                                              B3        |
|   N7:14                                                                                      |
|----| |-----------------------------------------------------------------------------(U)------|
| |   11     |                                                                  |  115     |  |
| |[3]       |                                                                  |          |  |
| |          | B3/115 - -| |- - File #2 MAIN_PRGRM - 297                          |MANUAL    |  |
| |          |          -|/|- - File #2 MAIN_PRGRM - 295                          |MOTOR 15  |  |
| |          |          -(L)- - File #2 MAIN_PRGRM - 582                          |REVERSE   |  |
| |          | N7:40/14 - -(L)- - File #2 MAIN_PRGRM - 582                        |ENABLE    |  |
| |PREPARE FOR| _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                       |MM15RE    |  |
| |AUTO RUN  | N7:35/11 - -(U)- - File #2 MAIN_PRGRM - 582                        |  N7:40   |  |
| |>AUTO     | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                        |---(U)----|  |
| |   N7:37  |                                                                  |   14     |  |
| |----| |---|                                                                  |          |  |
|       1                                                                       |MANUAL    |  |
| [162]                                                                         |MOTOR 15  |  |
|                                                                               |REVERSE   |  |
|                                                                               |DISABLE   |  |
|                                                                               |MM15RD    |  |
|                                                                               |  N7:35   |  |
|                                                                               |---(L)----|  |
|                                                                                   11         |
```

Rung #602

```
MOTOR 16                                                   MOTOR 16
REVERSE                                                    REVERSE
DISABLE                                                    M16R
M16RD                                                        B3
 N7:14                                                     --(U)--
--| |--                                                      116
   12
[3]                                                        MANUAL
        B3/116 - -| |- - File #2 MAIN_PRGRM - 306          MOTOR 16
                 -|/|- - File #2 MAIN_PRGRM - 306          REVERSE
                 -(L)- - File #2 MAIN_PRGRM - 583          ENABLE
        N7:40/15 - -(L)- - File #2 MAIN_PRGRM - 583        MM16RE
PREPARE FOR  _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2     N7:40
AUTO RUN     N7:35/12 - -(U)- - File #2 MAIN_PRGRM - 583   --(U)--
>AUTO        _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2      15
  N7:37
--| |--                                                    MANUAL
   1                                                       MOTOR 16
[162]                                                      REVERSE
                                                           DISABLE
                                                           MM16RD
                                                            N7:35
                                                           --(L)--
                                                              12
```

Rung #603

```
MOTOR 17                                                   MOTOR 17
REVERSE                                                    REVERSE
DISABLE                                                    M17R
M17RD                                                        B3
 N7:14                                                     --(U)--
--| |--                                                      117
   13
[3]                                                        MANUAL
        B3/117 - -| |- - File #2 MAIN_PRGRM - 312          MOTOR 17
                 -|/|- - File #2 MAIN_PRGRM - 310          REVERSE
                 -(L)- - File #2 MAIN_PRGRM - 584          ENABLE
        N7:41/0 - -(L)- - File #2 MAIN_PRGRM - 584         MM17RE
PREPARE FOR  _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2     N7:41
AUTO RUN     N7:35/13 - -(U)- - File #2 MAIN_PRGRM - 584   --(U)--
>AUTO        _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2       0
  N7:37
--| |--                                                    MANUAL
   1                                                       MOTOR 17
[162]                                                      REVERSE
                                                           DISABLE
                                                           MM17RD
                                                            N7:35
                                                           --(L)--
                                                              13
```

```
Rung #604
| MOTOR 18                                                                    |
| REVERSE                                                          MOTOR 18   |
| DISABLE                                                          REVERSE    |
| M18RD                                                            M18R       |
|   N7:14                                                             B3      |
|----] [------------------------------------------------------------+--(U)--+-|
| |  14     |                                                       |  118   | |
| |[3]      |                                                       |        | |
| |         | B3/118 - ] [ - - File #2 MAIN_PRGRM - 317             |MANUAL  | |
| |         |          ]/[ - - File #2 MAIN_PRGRM - 315             |MOTOR 18| |
| |         |          -(L)- - File #2 MAIN_PRGRM - 585             |REVERSE | |
| |         | N7:41/1 - -(L)- - File #2 MAIN_PRGRM - 585            |ENABLE  | |
| |PREPARE FOR | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2        |MM18RE  | |
| |AUTO RUN | N7:35/14 - -(U)- - File #2 MAIN_PRGRM - 585           | N7:41  | |
| |>AUTO    | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2           +--(U)---+ |
| |  N7:37  |                                                       |   1    | |
| +---] [---+                                                       |        | |
|      1                                                            |MANUAL  | |
| [162]                                                             |MOTOR 18| |
|                                                                   |REVERSE | |
|                                                                   |DISABLE | |
|                                                                   |MM18RD  | |
|                                                                   | N7:35  | |
|                                                                   +--(L)---+ |
|                                                                      14      |
Rung #605
  MOTOR 19                                                                    |
| REVERSE                                                          MOTOR 19   |
| DISABLE                                                          REVERSE    |
| M19RD                                                            M19R       |
|   N7:14                                                             B3      |
|----] [------------------------------------------------------------+--(U)--+-|
| |  15     |                                                       |  119   | |
| |[3]      |                                                       |        | |
| |         | B3/119 - ] [ - - File #2 MAIN_PRGRM - 322             |MANUAL  | |
| |         |          ]/[ - - File #2 MAIN_PRGRM - 320             |MOTOR 19| |
| |         |          -(L)- - File #2 MAIN_PRGRM - 586             |REVERSE | |
| |         | N7:41/2 - -(L)- - File #2 MAIN_PRGRM - 586            |ENABLE  | |
| |PREPARE FOR | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2        |MM19RE  | |
| |AUTO RUN | N7:35/15 - -(U)- - File #2 MAIN_PRGRM - 586           | N7:41  | |
| |>AUTO    | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2           +--(U)---+ |
| |  N7:37  |                                                       |   2    | |
| +---] [---+                                                       |        | |
|      1                                                            |MANUAL  | |
| [162]                                                             |MOTOR 19| |
|                                                                   |REVERSE | |
|                                                                   |DISABLE | |
|                                                                   |MM19RD  | |
|                                                                   | N7:35  | |
|                                                                   +--(L)---+ |
|                                                                      15      |
```

Rung #606

```
| MOTOR 20                                                          MOTOR 20
| REVERSE                                                           REVERSE
| DISABLE                                                           M20R
| M20RD                                                               B3
|  N7:15                                                            --(U)--
|---] [---                                                            120
|    0
| [3]                                                               MANUAL
|        B3/120 - ] [ - - File #2 MAIN_PRGRM - 333                  MOTOR 20
|                 ]/[ - - File #2 MAIN_PRGRM - 331                  REVERSE
|                 -(L)- - File #2 MAIN_PRGRM - 587                  ENABLE
|        N7:41/3 - -(L)- - File #2 MAIN_PRGRM - 587                 MM20RE
| PREPARE FOR  _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2           N7:41
| AUTO RUN     N7:36/0 - -(U)- - File #2 MAIN_PRGRM - 587           --(U)--
| >AUTO        _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2             3
|  N7:37
|---] [---                                                          MANUAL
|    1                                                              MOTOR 20
| [162]                                                             REVERSE
|                                                                   DISABLE
|                                                                   MM20RD
|                                                                    N7:36
|                                                                   --(L)--
|                                                                      0
```

Rung #607

```
| MOTOR 21
| REVERSE                                                           MOTOR 21
| DISABLE                                                           REVERSE
| M21RD                                                             M21R
|  N7:15                                                              B3
|---] [---                                                          --(U)--
|    1                                                                121
| [3]
|        B3/121 - ] [ - - File #2 MAIN_PRGRM - 357                  MANUAL
|                 ]/[ - - File #2 MAIN_PRGRM - 355                  MOTOR 21
|                 -(L)- - File #2 MAIN_PRGRM - 588                  REVERSE
|        N7:41/4 - -(L)- - File #2 MAIN_PRGRM - 588                 ENABLE
| PREPARE FOR  _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2           MM21_RE
| AUTO RUN     N7:36/1 - -(U)- - File #2 MAIN_PRGRM - 588            N7:41
| >AUTO        _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2          --(U)--
|  N7:37                                                               4
|---] [---
|    1                                                              MANUAL
| [162]                                                             MOTOR 21
|                                                                   REVERSE
|                                                                   DISABLE
|                                                                   MM21RD
|                                                                    N7:36
|                                                                   --(L)--
|                                                                      1
```

Rung #608

```
                                                              AUTO VENT
                                                              GREATER THEN
                                                              3 MINUTES
                                                              AUTOVENT>3M
  VNT1TMR                                                        B3
  T4:168
--] [----------------------------------------------------------( )--
   DN                                                            837
 [406]
                 B3/837 - ] [ - File #2 MAIN_PRGRM - 624
 VNT2TMR
  T4:199
--] [--
   DN
 [412]
 VNT3TMR
  T4:242
--] [--
   DN
 [419]
 VNT4TMR
  T4:248
--] [--
   DN
 [426]
 VNT5TMR
  T4:252
--] [--
   DN
 [431]
 SYSVNTPLSE
    T4:286
--] [--
    DN
 [370]
```

Rung #609

```
|                                                                     AUTO PUMPDOWN  |
|                                                                     >10 MINUTES    |
|  PMP1TMR                                                            PD>10M         |
|  T4:256                                                                B3         |
|-+---] [---+--------------------------------------------------------------( )------|
| |  DN     |                                                              838        |
| |[435]    |                                                                         |
| |         | B3/838 - -] [- - File #2 MAIN_PRGRM - 624                               |
| |PMP2TMR  |                                                                         |
| | T4:262  |                                                                         |
| |---] [---|                                                                         |
| |  DN     |                                                                         |
| |[439]    |                                                                         |
| |PMP3TMR  |                                                                         |
| | T4:288  |                                                                         |
| |---] [---|                                                                         |
| |  DN     |                                                                         |
| |[443]    |                                                                         |
| |PMP4TMR  |                                                                         |
| | T4:295  |                                                                         |
| |---] [---|                                                                         |
| |  DN     |                                                                         |
| |[448]    |                                                                         |
| |PMP5TRM  |                                                                         |
| | T4:296  |                                                                         |
| |---] [---|                                                                         |
|    DN     |                                                                         |
| |[452]    |                                                                         |
| |PDSTMR   |                                                                         |
| | T4:190  |                                                                         |
| +--] [----+                                                                         |
|   DN                                                                                |
|  [25]                                                                               |
```

Rung #610

```
|PALLET     PALLET                                                                  |
|DETECTED   DETECTED                                                                |
|LEFT SIDE  RIGHT SIDE                                              SENSOR 1 AND    |
|ENTRANCE   ENTRANCE                                                SENSOR 3        |
|SEN1       SEN3                                                    SEN1_3          |
|  I:003      I:003                                                    B3           |
|---] [---------] [------------------------------------------------------( )--------|
|   00          02                                                     51           |
```

Rung #611

```
|FIX--A_B                                                 FIX A-B                   |
|COMM                                                     COMMUNICATIONS            |
|CHECK                                                    TIMER                     |
|FIX_AB_COMM                                              FIX__A-B_THR              |
|   B3                                                    +--TON-------------+      |
|---] [---------------------------------------------------|TIMER ON DELAY    |-(EN)-|
|   525                                                   |TIMER:       T4:69|      |
|                                                         |BASE (SEC):    1.0|-(DN) |
| T4:69.DN - -] [- - File #2 MAIN_PRGRM - 612             |PRESET:         15|      |
|                                                         |ACCUM:           0|      |
|                                                         +------------------+      |
```

Rung #612
```
|FIX                                                                  FIX_A-B          |
|AB                                                                   COMMUNICATIONS   |
|TIMER                                                                LOST!            |
|FIX__A-B_TMR                                                         NO_FX_A-B_COMM   |
|    T4:69                                                                 B3          |
|----] [---------------------------------------------------------------------(L)-------|
|     DN                                                                  810          |
|[611]                                                                                 |
B3/810 - ] [ - - File #2 MAIN_PRGRM -  626
         -(L)- - File #2 MAIN_PRGRM -  612
         -(U)- - File #2 MAIN_PRGRM -  617
```

Rung #613
```
|ARGON GAS                                                               NO ARGON     |
|PRESSURE                                                                SIGNAL TO    |
|SENSOR                                                                  THE FIX      |
|NO_ARGON                                                                NO=ARGON     |
|   I:052                                                                   B3        |
|----] [----------------------------------------------------------------------(L)-----|
|    03                                                                    809        |
B3/809 - ] [ - - File #2 MAIN_PRGRM -  626
         -(L)- - File #2 MAIN_PRGRM -  613
         -(U)- - File #2 MAIN_PRGRM -  617
```

Rung #614
```
|AUTO     PROCESS                                                                     |
|MODE     PRESSURE                                       PRESSURE FAIL                |
|ENABLE   FAILURE                                        TIMER                        |
 UTO      PRESS_FAILURE                                  PRESS_FAIL_TMR               |
| N7:37      B3                                          +-TON-----------------+      |
|--] [-------] [-----------------------------------------+TIMER ON DELAY       +-(EN)-|
|   11      529                                          |TIMER:       T4:331  |      |
|[158]                                                   |BASE (SEC):    1.0   +-(DN) |
|                                                        |PRESET:         10   |      |
|                                                        |ACCUM:           0   |      |
|                                                        +---------------------+      |
T4:331.DN - ] [ - - File #2 MAIN_PRGRM -  615
```

Rung #615
```
|                                                                     PRESSURE       |
|                                                                     FAILURE        |
|PRESS_FAIL_TMR                                                       PRESS_FAIL     |
|     T4:331                                                              B3         |
|------] [------------------------------------------------------------------(L)------|
|       DN                                                               388         |
|[614]                                                                               |
B3/388 - ] [ - - File #2 MAIN_PRGRM -  627
         -(L)- - File #2 MAIN_PRGRM -  615
         -(U)- - File #2 MAIN_PRGRM -  617
```

Rung #616
```
|AUTO                                                                                |
 ODE     ARGON FLOW                                                   NO_ARGON       |
|ENABLE  FAILURE                                                      LATCH          |
|AUTO    NO_ARGON_FLOW                                                NO_ARGONLTCH   |
| N7:37     B3                                                            B3         |
|--] [------] [-------------------------------------------------------------(L)------|
|   11     528                                                          387          |
|[158]                                                                               |
B3/387 - ] [ - - File #2 MAIN_PRGRM -  627
         -(L)- - File #2 MAIN_PRGRM -  616
         -(U)- - File #2 MAIN_PRGRM -  617
```

Rung #617

```
|PAUSE                                                              NO_ARGON       |
|DISABLE                                                            LATCH          |
|TS12                                                               NO_ARGONLTCH   |
| N7:16                                                                B3          |
|---] [---------------------------------------------------------------+---(U)----+-|
|    4                                                                |   387    | |
|[3]                                                                  |          | |
| B3/387 - ] [ - - File #2 MAIN_PRGRM - 627                           |          | |
|          -(L)- - File #2 MAIN_PRGRM - 616                           |PRESSURE  | |
| B3/388 - ] [ - - File #2 MAIN_PRGRM - 627                           |FAILURE   | |
|          -(L)- - File #2 MAIN_PRGRM - 615                           |PRESS_FAIL| |
| B3/272 - ] [ - - File #2 MAIN_PRGRM - 627                           |   B3     | |
|          -(L)- - File #2 MAIN_PRGRM - 619                           +---(U)----+ |
| B3/809 - ] [ - - File #2 MAIN_PRGRM - 626                           |   388    | |
|          -(L)- - File #2 MAIN_PRGRM - 613                           |          | |
| B3/810 - ] [ - - File #2 MAIN_PRGRM - 626                           |          | |
|          -(L)- - File #2 MAIN_PRGRM - 612                           |          | |
|                                                                     |ARC DETECT| |
|                                                                     |LATCH     | |
|                                                                     |ARC_DET   | |
|                                                                     |   B3     | |
|                                                                     +---(U)----+ |
|                                                                     |   272    | |
|                                                                     |NO ARGON  | |
|                                                                     |SIGNAL TO | |
|                                                                     |THE FIX   | |
|                                                                     |NO=ARGON  | |
|                                                                     |   B3     | |
|                                                                     +---(U)----+ |
|                                                                     |   809    | |
|                                                                     |FIX_A-B   | |
|                                                                     |COMMUNICATIONS |
|                                                                     |LOST!     | |
|                                                                     |NO_FX_A-B_COMM |
|                                                                     |   B3     | |
|                                                                     +---(U)----+ |
|                                                                         810      |
```

```
Rung #618
| CHROME ARC                                                                             ARC FAULT          |
| DETECT #1                                                                              DELAY              |
| CHR_ARC1                                                                               ARCFLTDLY          |
|    B3                                                                                 +--TON-----------+  |
+---] [---+-----------------------------------------------------------------------------+TIMER ON DELAY  +-(EN)-+
| |  534  |                                                                             |TIMER:   T4:100 |  |
| |       |                                                                             |BASE (SEC):  1.0+-(DN) |
| |       | T4:100.DN - ] [ - File #2 MAIN_PRGRM - 619                                  |PRESET:      10 |  |
| |       |                                                                             |ACCUM:        0 |  |
| |MAG ARC|                                                                             +----------------+  |
| |DETECT #1                                                                                              |
| |MAG_ARC1                                                                                               |
| |  B3   |                                                                                               |
| +--] [--+                                                                                               |
| |  535  |                                                                                               |
| |CARBON ARC                                                                                             |
| |DETECT #1                                                                                              |
| |CAR_ARC1                                                                                               |
| |  B3   |                                                                                               |
| +--] [--+                                                                                               |
| |  536  |                                                                                               |
| |CHROME ARC                                                                                             |
| |DETECT #2                                                                                              |
| |CHR_ARC2                                                                                               |
| |  B3   |                                                                                               |
| +--] [--+                                                                                               |
| |  540  |                                                                                               |
| |MAG ARC|                                                                                               |
| |DETECT #2                                                                                              |
| |MAG_ARC2                                                                                               |
| |  B3   |                                                                                               |
| +--] [--+                                                                                               |
| |  541  |                                                                                               |
| |CARBON ARC                                                                                             |
| |DETECT #2                                                                                              |
| |CAR_ARC2                                                                                               |
| |  B3   |                                                                                               |
| +--] [--+                                                                                               |
|    542                                                                                                  |
Rung #619
|                                                                                           ARC DETECT |
|                                                                                           LATCH      |
|ARCFLTDLY                                                                                  ARC_DET    |
| T4:100                                                                                       B3      |
+---] [--------------------------------------------------------------------------------------(L)-------+
|    DN                                                                                       272      |
|[618]                                                                                                 |
B3/272 - ] [ - - File #2 MAIN_PRGRM -  627
       -(L)- - File #2 MAIN_PRGRM -  619
       -(U)- - File #2 MAIN_PRGRM -  617
```

```
Rung #620
           CHROME
HIGH POWER POWER SUPPLY                                   POWER SUPPLY
CHROME 1 & 2 SETPOINT ALARM                               SETPOINT ALARM
TO THE FIX  1                                             DELAY
HIPRCH1,2   CHRSPAL1                                      PSSPALMDLY
   B3          B3                                         TON
--| |---------| |------------------------------------------TIMER ON DELAY  -(EN)-
  831         531                                         TIMER:    T4:333
[236]                                                     BASE (SEC): 1.0 -(DN)
                      T4:333.DN - | | - File #2 MAIN_PRGRM - 621  PRESET:   10
                                                          ACCUM:     0
            MAGNETIC
HIGH POWER  POWER SUPPLY
MAG 1 & 2   SETPOINT ALARM
TO THE FIX  1
HIMAG1,2    MAGSPAL1
   B3          B3
--| |---------| |--
  833         532
[268]
            CARBON
HIGH POWER  POWER SUPPLY
CARBON 1 & 2 SETPOINT ALARM
TO THE FIX  1
HIPRCAR1,2  CARSPAL1
   B3          B3
--| |---------| |--
  835         533
[299]
HIGH POWER  CHROME PS
CHROME 3 & 4 SETPOINT ALARM
TO THE FIX  2
HIPRCHR3,4  CHRSPAL2
   B3          B3
--| |---------| |--
  832         537
[242]
HIGH POWER  MAG PS
MAG 3 & 4   SETPOINT ALARM
TO THE FIX  2
HIPRMAG3,4  MAGSPAL2
   B3          B3
--| |---------| |--
  834         538
[274]
HIGH POWER  CARBON PS
CARBON 3 & 4 SETPOINT ALARM
TO THE FIX  2
'IPRCAR3,4  CARSPAL2
   B3          B3
--| |---------| |--
  836         539
[300]
Rung #621
                                                          POWER SUPPLY
PSSPALMDLY                                                SETPOINT ALARM
 T4:333                                                   PSSPALARM
                                                             B3
--| |---------------------------------------------------------(L)--
  DN                                                         147
[620]
```

```
B3/147 - -| |- - File #2 MAIN_PRGRM -  625
        -(L)- - File #2 MAIN_PRGRM -  621
        -(U)- - File #2 MAIN_PRGRM -  629
Rung #622
| HIGH POWER                                                           POWER SUPPLY |
| CHROME 1 & 2                                                         HIGH POWER   |
| TO THE FIX                                                           ON           |
| HIPRCH1,2                                                            HIPWRON      |
|        B3                                                                B3       |
|-+-----| |---+-------------------------------------------------------------( )-----|
| |      831  |                                                            301      |
| |[236]      |                                                                     |
| |HIGH POWER |                                                                     |
| |CHROME 3 & 4                                                                     |
| |TO THE FIX |                                                                     |
| |HIPRCHR3,4 |                                                                     |
| |     B3    |                                                                     |
| |----| |----|                                                                     |
| |    832    |                                                                     |
| |[242]      |                                                                     |
| |HIGH POWER |                                                                     |
| |MAG 1 & 2  |                                                                     |
| |TO THE FIX |                                                                     |
| |HIMAG1,2   |                                                                     |
| |     B3    |                                                                     |
| |----| |----|                                                                     |
| |    833    |                                                                     |
|  [268]      |                                                                     |
| |HIGH POWER |                                                                     |
| |MAG 3 & 4  |                                                                     |
| |TO THE FIX |                                                                     |
| |HIPRMAG3,4 |                                                                     |
| |     B3    |                                                                     |
| |----| |----|                                                                     |
| |    834    |                                                                     |
| |[274]      |                                                                     |
| |HIGH POWER |                                                                     |
| |CARBON 1 & 2                                                                     |
| |TO THE FIX |                                                                     |
| |HIPRCAR1,2 |                                                                     |
| |     B3    |                                                                     |
| |----| |----|                                                                     |
| |    835    |                                                                     |
| |[299]      |                                                                     |
| |HIGH POWER |                                                                     |
| |CARBON 3 & 4                                                                     |
| |TO THE FIX |                                                                     |
| |HIPRCAR3,4 |                                                                     |
| |     B3    |                                                                     |
| +----| |----+                                                                     |
|      836                                                                          |
|  [300]                                                                            |
```

Rung #623

```
                                                                        RERUF GREATER
                                                                        THAN 10
                                                                        TIMES
 C1RERUF                                                                RERUF>10
  C5:1                                                                     B3
--] [------------------------------------------------------------------------( )--
   DN                                                                      819
 [3:19]
          B3/819 - ] [ - File #2 MAIN_PRGRM - 624
 C2RERUF
  C5:2
--] [--
   DN
 [3:196]
 C2RERUF
  C5:2
--] [--
   DN
 [3:196]
 C3RERUF
  C5:3
--] [--
   DN
 [3:197]
 C4RERUF
  C5:4
--] [--
   DN
 [3:198]
 C5RERUF
  C5:5
--] [--
   DN
 [3:199]
 C6R3RUF
  C5:6
--] [--
   DN
 [3:200]
 C7RERUF
  C5:7
--] [--
   DN
 [3:201]
 C8RERUF
  C5:8
--] [--
   DN
 [3:202]
```

Rung #624

```
| PAUSE                                         PAUSE                                                      |
| LATCH                          OSCILLATOR     LATCH                                                      |
| ENABLE                         2              ENABLE                                      ALARM LIGHT    |
| PLE                            OSC2           PLE                                         ALRMLITE       |
|  N7:37                              B3        N7:37                                           O:033      |
|---] [-------------------------+----] [--------]/[---+------------------------------------------( )-------|
| |  3                          | |   143        3    |                                           16       |
| |[625]                        | |[11]          [625] |                                                    |
| |CRYO REGEN                   | |PAUSE               |                                                    |
| |ROUGHING                     | |LATCH               |                                                    |
| |TIMEOUT                      | |ENABLE  OSCILLATOR  |                                                    |
| |CR_RUFF_TIME                 | |PLE     OSC         |                                                    |
| |        B3                   | | N7:37      B3      |                                                    |
| |-------] [-------------------| |---] [------] [-----+                                                    |
| |       818                   |     3        142                                                        |
| |[3:31]                       |   [625]   [7]                                                           |
| |RERUF GREATER                |                                                                         |
| |THAN 10                      |                                                                         |
| |TIMES                        |                                                                         |
| |RERUF>10                     |                                                                         |
| |        B3                   |                                                                         |
| |-------] [-------------------|                                                                         |
| |       819                   |                                                                         |
| |[623]                        |                                                                         |
| |CRYO REGEN                   |                                                                         |
| |COOL DOWN                    |                                                                         |
| |>2 HOURS                     |                                                                         |
| |CR_CD>2H                     |                                                                         |
| |      B3                     |                                                                         |
| |-----] [---------------------|                                                                         |
| |     820                     |                                                                         |
| |[3:32]                       |                                                                         |
| |AUTO VENT                    |                                                                         |
| |GREATER THEN                 |                                                                         |
| |3 MINUTES                    |                                                                         |
| |AUTOVENT>3M                  |                                                                         |
| |       B3                    |                                                                         |
| |------] [--------------------|                                                                         |
| |      837                    |                                                                         |
| |[608]                        |                                                                         |
| |PIRINI                       |                                                                         |
| |GUAGE NO                     |                                                                         |
| |FAULT                        |                                                                         |
| |PGNF                         |                                                                         |
| |     B3                      |                                                                         |
| |----]/[---------------------|                                                                          |
| |    465                      |                                                                         |
| |[5:205]                      |                                                                         |
| |AUTO PUMPDOWN                |                                                                         |
| |>10 MINUTES                  |                                                                         |
| |PD>10M                       |                                                                         |
| |       B3                    |                                                                         |
| |------] [--------------------|                                                                         |
| |      838                    |                                                                         |
| |[609]                        |                                                                         |
| |AUTO                         |                                                                         |
| |MODE     POLYCOLD            |                                                                         |
| |ENABLE   SETPOINT LOW        |                                                                         |
| |AUTO     PCSPL               |                                                                         |
| | N7:37         I:002         |                                                                         |
| +---] [----------]/[----------+                                                                         |
|     11            02                                                                                    |
>                                                                                                         >
```

```
[158]
Rung #625
AUTO
MODE                PAUSE                                                              PAUSE
ENABLE              ENABLE                                                             LATCH
AUTO                TS11                                                               ENABLE
N7:37               N7:16                                                              PLE
                                                                                       N7:37
--] [--             --] [--                                                            --(L)--
 11                  3                                                                   3
[158]               [3]
                           N7:37/3 - ] [ - - File #2 MAIN_PRGRM - 624, 635, 636, 637, 638, 639, 640,
                                         641, 642, 643, 644, 645, 646, 647, 648, 649, 650
                                     ]/[ - - File #2 MAIN_PRGRM - 181, 200, 215, 326, 327, 351, 624    PAUSE
                                     -(U)- - File #2 MAIN_PRGRM - 628                                  LATCH
PREPARE FOR         POWER SUPPLY   _F:N7:21%21 - BTW - File #2 MAIN_PRGRM - 2                          DISABLE
AUTO RUN            SETPOINT ALARM N7:37/4 - -(L)- - File #2 MAIN_PRGRM - 628                          PLD
>AUTO               PSSPALARM      _F:N7:21%21 - BTW - File #2 MAIN_PRGRM - 2                          N7:37
  N7:37               B3                                                                               --(U)--
--] [--             --] [--                                                                              4
   1                  147
[162]               [621]
                    DOOR FAULT
                    DRFLT
                      B3
                    --] [--
                      215
                    [5:67]
                    HIVAC VALVE
                    FAULT
                    HVFLT
                      B3
                    --] [--
                      245
                    [5:142]
                    CHAMBER
                    VENT VALVE
                    FAULT
                    CHVF
                      B3
                    --] [--
                      174
                    [5:157]
                    ROUGH VENT
                    VALVE
                    FAULT
                    RVVF
                      B3
                    --] [--
                      386
                    [5:180]
                    HEATER
                    SHIELD H2O
                    FLOW FAULT
                    HSFF
                      B3
                    --] [--
                      219
                    [5:200]
                    CATHODE
                    H2O FLOW
                    FAULT
                    CWFF
```

```
<                                                                         <
|                 <                        <                              |
|                 |    B3                  |                              |
|                 |---] [------------------|                              |
|                 |   220                  |                              |
|                 |[5:203]                 |                              |
|                 |EMERGENCY               |                              |
|                 |STOP                    |                              |
|                 |E_STOP                  |                              |
|                 |    I:005               |                              |
|                 |----]/[-----------------|                              |
|                 |     15                 |                              |
|                 |AUXILLIARY              |                              |
|                 |PAUSE LATCH             |                              |
|                 |SIGNALS                 |                              |
|                 |AUXPL                   |                              |
|                 |     B3                 |                              |
|                 |-----] [----------------|                              |
|                 |     199                |                              |
|                 |[626]                   |                              |
|                 |AUXILLIARY              |                              |
|                 |PAUSE 2 LATCH           |                              |
|                 |AUX2PL                  |                              |
|                 |      B3                |                              |
|                 +------] [---------------+                              |
|                        390                                              |
|                  [627]
```

Rung #626

```
|  NO ARGON                                                                         AUXILLIARY  |
|  SIGNAL TO                                                                        PAUSE LATCH |
|  THE FIX                                                                          SIGNALS     |
|  NO=ARGON                                                                         AUXPL       |
|     B3                                                                               B3       |
|-+---| |---------+--------------------------------------------------------------------( )------|
| |   809         |                                                                    199      |
| |[617]          |                                                                             |
| |               | B3/199 - -| |- - File #2 MAIN_PRGRM - 625                                   |
| |FIX_A-B        |                                                                             |
| |COMMUNICATIONS |                                                                             |
| |LOST!          |                                                                             |
| |NO_FX_A-B_COMM |                                                                             |
| |      B3       |                                                                             |
| |-----| |---[AFI]|                                                                            |
| |      810      |                                                                             |
| |[617]          |                                                                             |
| |MOTOR FAULT    |                                                                             |
| |TIMER DONE     |                                                                             |
| |MOTOR_FLT      |                                                                             |
| |     B3        |                                                                             |
| |----| |--------|                                                                             |
| |     811       |                                                                             |
| |[5:15]         |                                                                             |
| |CHAMBER        |                                                                             |
| |NOT AT         |                                                                             |
| |VACUUM         |                                                                             |
| |NO_VACUUM      |                                                                             |
| |    B3         |                                                                             |
| |----| |--------|                                                                             |
| |    812        |                                                                             |
| |[633]          |                                                                             |
| |CRYO TEMP      |                                                                             |
| |ABOVE 20K      |                                                                             |
| |CRYO_>20K      |                                                                             |
| |    B3         |                                                                             |
| |----| |--------|                                                                             |
| |    813        |                                                                             |
| |[630]          |                                                                             |
| |LOAD LOCK      |                                                                             |
| |VENT >30 SECS  |                                                                             |
| |LLVNT>30SECS   |                                                                             |
| |     B3        |                                                                             |
| |-----| |-------|                                                                             |
| |     814       |                                                                             |
| |[176]          |                                                                             |
| |EXIT LOCK      |                                                                             |
| |VENT>30 SECS   |                                                                             |
| |EXLKVNT>30SECS |                                                                             |
| |      B3       |                                                                             |
| |-----| |-------|                                                                             |
| |     815       |                                                                             |
| |[349]          |                                                                             |
| |LOAD LOCK      |                                                                             |
| |ROUGHING       |                                                                             |
| |>60 SECONDS    |                                                                             |
| |LLRUF>60       |                                                                             |
| |    B3         |                                                                             |
| |----| |--------|                                                                             |
| |    816        |                                                                             |
| |[170]          |                                                                             |
| |EXIT LOCK      |                                                                             |
> >               >                                                                             >
```

```
< <                                  <
| |ROUGHING                          |
| |>60 SEC                           |
| |EXLKRUFF>60S                      |
| |          B3                      |
| |---------] [----------------------|
| |          817                     |
| |[343]                             |
| |CHAMBER                           |
| |COVERS                            |
| |CLOSED                            |
| |CCC                               |
| |     B3                           |
| |----] [---------------------------|
| |     467                          |
| |[5:207]                           |
| |MECHANICAL                        |
| |PUMP FAILURE                      |
| |MECH_P_FAIL                       |
| |          B3                      |
| +---------] [----------------------+
|            385
|  [5:188]
```

Rung #627

```
| ARC DETECT                                                                       AUXILLIARY     |
| LATCH                                                                            PAUSE 2 LATCH  |
| ARC_DET                                                                          AUX2PL         |
|     B3                                                                               B3         |
|-+---] [---+------------------------------------------------------------------------( )--------|
| |   272   |                                                                          390        |
| |[619]    |                                                                                     |
| |         | B3/390 - ] [ - File #2 MAIN_PRGRM - 625                                             |
| |PRESSURE |                                                                                     |
| |FAILURE  |                                                                                     |
| |PRESS_FAIL                                                                                     |
| |    B3   |                                                                                     |
| +---] [---+                                                                                     |
| |   388   |                                                                                     |
| |[617]    |                                                                                     |
| |NO_ARGON |                                                                                     |
| |LATCH    |                                                                                     |
| |NO_ARGONLTCH                                                                                   |
| |    B3   |                                                                                     |
| +---] [---+                                                                                     |
| |   387   |                                                                                     |
| |[617]    |                                                                                     |
| |AIR PRESSURE                                                                                   |
| |SWITCH   |                                                                                     |
| |APS      |                                                                                     |
| |  I:003  |                                                                                     |
| +---]/[---+                                                                                     |
| |    17   |                                                                                     |
| |HEATER ALARM                                                                                   |
| |HTRALM   |                                                                                     |
| |    B3   |                                                                                     |
| +---] [---+                                                                                     |
| |   290   |                                                                                     |
| |[152]    |                                                                                     |
| |HEATER   |                                                                                     |
| |SUPPLY   |                                                                                     |
| |ALARM    |                                                                                     |
| |HTRFLT   |                                                                                     |
| |   B3    |                                                                                     |
| +---] [---+                                                                                     |
|    289                                                                                          |
|   [631]                                                                                         |
```

400

BASE : Rung #628

```
| ARC DETECT                                                         AUXILLIARY     |
| LATCH                                                              PAUSE 2 LATCH  |
| ARC_DET                                                            AUX2PL         |
|       B3                                                             B3           |
|-+---] [---+-----------------------------------------------------------( )--------|
| |   272   |                                                         390           |
| |[620]    |                                                                       |
| |         | B3/390 - ] [ - File #2 MAIN_PRGRM - 626                                 |
| |PRESSURE |                                                                       |
| |FAILURE  |                                                                       |
| |PRESS_FAIL                                                                       |
| |     B3  |                                                                       |
| +---] [---+                                                                       |
| |   388   |                                                                       |
| |[618]    |                                                                       |
| |NO_ARGON |                                                                       |
| |LATCH    |                                                                       |
| |NO_ARGONLTCH                                                                     |
| |      B3 |                                                                       |
| +----] [--+                                                                       |
| |    387  |                                                                       |
| |[618]    |                                                                       |
| |AIR PRESSURE                                                                     |
| |SWITCH   |                                                                       |
| |APS      |                                                                       |
| |   I:003 |                                                                       |
| +----]/[--+                                                                       |
| |    17   |                                                                       |
| |     HEATER ALARM                                                                |
| |     HTRALM                                                                      |
| |         B3                                                                      |
| +-[AFI]-----] [---+                                                               |
| |          290    |                                                               |
| |     [152]       |                                                               |
| |HEATER   |                                                                       |
| |SUPPLY   |                                                                       |
| |ALARM    |                                                                       |
| |HTRFLT   |                                                                       |
| |   B3    |                                                                       |
| +--] [----+                                                                       |
|   289                                                                             |
|  [632]                                                                            |
```

401

```
Rung #629
|PAUSE                                                                     POWER SUPPLY      |
|DISABLE                                                                   SETPOINT ALARM    |
|TS12                                                                      PSSPALARM         |
| N7:16                                                                        B3            |
|--] [---------------------------------------------------------------------+----(U)-------+--|
|   4                                                                      |    147       |  |
|[3]                                                                       |              |  |
| B3/147 - ] [ - - File #2 MAIN_PRGRM - 625                                |              |  |
|          -(L)- - File #2 MAIN_PRGRM - 621                                |STOP MOTOR 6  |  |
| B3/474 - ]/[ - - File #2 MAIN_PRGRM - 218                                |PAUSE LATCH   |  |
|          -(L)- - File #2 MAIN_PRGRM - 638                                |M6PL          |  |
| B3/475 - ]/[ - - File #2 MAIN_PRGRM - 258                                |    B3        |  |
|          -(L)- - File #2 MAIN_PRGRM - 641                                +----(U)-------+  |
| B3/476 - ]/[ - - File #2 MAIN_PRGRM - 290                                |    474       |  |
|          -(L)- - File #2 MAIN_PRGRM - 644                                |              |  |
| B3/477 - ]/[ - - File #2 MAIN_PRGRM - 315                                |              |  |
|          -(L)- - File #2 MAIN_PRGRM - 647                                |              |  |
|                                                                          |STOP MOTOR 10 |  |
|                                                                          |PAUSE LATCH   |  |
|                                                                          |M10PL         |  |
|                                                                          |    B3        |  |
|                                                                          +----(U)-------+  |
|                                                                          |    475       |  |
|                                                                          |STOP MOTOR 14 |  |
|                                                                          |PAUSE LATCH   |  |
|                                                                          |M14PL         |  |
|                                                                          |    B3        |  |
|                                                                          +----(U)-------+  |
|                                                                          |    476       |  |
|                                                                          |STOP MOTOR 18 |  |
|                                                                          |PAUSE LATCH   |  |
|                                                                          |M18PL         |  |
|                                                                          |    B3        |  |
|                                                                          +----(U)-------+  |
|                                                                               477           |
```

```
Rung #630
|AUTO      CRYO 1                                                      CRYO TEMP  |
|MODE      TEMPERATUR                                                  ABOVE 20K  |
|ENABLE    =<20K                                                       CRYO_>20K  |
|AUTO      CY1TMP20                                                       B3      |
| N7:37       B3                                                                  |
|--| |-----+--|/|--+-----------------------------------------------------(L)------|
|   11     |  501  |                                                      813     |
|[158]     |       |                                                              |
|          |       | B3/813 - -| |- - File #2 MAIN_PRGRM - 626                    |
|          |CRYO 2 |           -(U)- - File #2 MAIN_PRGRM - 632                   |
|          |TEMPERATUR                                                            |
|          |=<20K  |                                                              |
|          |CY2TMP20                                                              |
|          |  B3   |                                                              |
|          +--|/|--+                                                              |
|          |  502  |                                                              |
|          |CRYO 3 |                                                              |
|          |TEMPERATUR                                                            |
|          |=<20K  |                                                              |
|          |CY3TMP20                                                              |
|          |  B3   |                                                              |
|          +--|/|--+                                                              |
|          |  503  |                                                              |
|          |CRYO 4 |                                                              |
|          |TEMPERATUR                                                            |
|          |=<20K  |                                                              |
|          |CY4TMP20                                                              |
|          |  B3   |                                                              |
|          +--|/|--+                                                              |
|          |  504  |                                                              |
|          |CRYO 5 |                                                              |
|          |TEMPERATUR                                                            |
|          |=<20K  |                                                              |
|          |CY5TMP20                                                              |
|          |  B3   |                                                              |
|          +--|/|--+                                                              |
|          |  505  |                                                              |
|          |CRYO 6 |                                                              |
|          |TEMPERATUR                                                            |
|          |=<20K  |                                                              |
|          |CY6TMP20                                                              |
|          |  B3   |                                                              |
|          +--|/|--+                                                              |
|          |  506  |                                                              |
|          |CRYO 7 |                                                              |
|          |TEMPERATUR                                                            |
|          |=<20K  |                                                              |
|          |CY7TMP20                                                              |
|          |  B3   |                                                              |
|          +--|/|--+                                                              |
|          |  507  |                                                              |
|          |CRYO 8 |                                                              |
|          |TEMPERATUR                                                            |
|          |=<20K  |                                                              |
|          |CY8TMP20                                                              |
|          |  B3   |                                                              |
|          +--|/|--+                                                              |
|          |  508  |                                                              |
|          |CRYO 9 |                                                              |
|          |TEMPERATUR                                                            |
|          |=<20K  |                                                              |
|          |CY9TMP20                                                              |
>          >       >                                                              >
```

```
       B3
----| / |----
      509
CRYO 10
TEMPERATUR
=<20K
CY10TMP20
       B3
----| / |----
      510
CRYO 11
TEMPERATUR
=<20K
CY11TMP20
       B3
----| / |----
      511
CRYO 12
TEMPERATUR
=<20K
CY12TMP20
       B3
----| / |----
      512
```

404

Rung #631

```
|AUTO                                                         HEATER |
|MODE      HEATER 1A                                          SUPPLY |
|ENABLE    NO FAULT                                           ALARM  |
|AUTO      H1AOFLT                                            HTRFLT |
| N7:37      I:025                                              B3   |
|--] [-----+---]/[---+----------------------------------------( )----|
|   11     |    06   |                                          289  |
|[158]     |         |                                               |
|          |         | B3/289 - ] [ - File #2 MAIN_PRGRM - 627       |
|          |HEATER 1B|                                               |
|          |NO FAULT |                                               |
|          |H1BOFLT  |                                               |
|          |  I:025  |                                               |
|          +---]/[---+                                               |
|          |    07   |                                               |
|          |HEATER 2A|                                               |
|          |NO FAULT |                                               |
|          |H2AOFLT  |                                               |
|          |  I:025  |                                               |
|          +---]/[---+                                               |
|          |    10   |                                               |
|          |HEATER 2B|                                               |
|          |NOFAULT  |                                               |
|          |H2BOFLT  |                                               |
|          |  I:025  |                                               |
|          +---]/[---+                                               |
|          |    11   |                                               |
|          |HEATER 2C|                                               |
|          |NO FAULT |                                               |
|          |H2COFLT  |                                               |
|          |  I:026  |                                               |
|          +---]/[---+                                               |
|          |    04   |                                               |
|          |HEATER 3A|                                               |
|          |NO FAULT |                                               |
|          |H3AOFLT  |                                               |
|          |  I:026  |                                               |
|          +---]/[---+                                               |
|          |    05   |                                               |
|          |HEATER 3B|                                               |
|          |NO FAULT |                                               |
|          |H3BOFLT  |                                               |
|          |  I:026  |                                               |
|          +---]/[---+                                               |
|          |    06   |                                               |
|          |HEATER 3C|                                               |
|          |NO FAULT |                                               |
|          |H3COFLT  |                                               |
|          |  I:026  |                                               |
|          +---]/[---+                                               |
|               07                                                    |
```

Rung #632

```
|PAUSE                                                      CRYO TEMP |
|DISABLE                                                    ABOVE 20K |
|TS12                                                       CRYO_>20K |
| N7:16                                                        B3     |
|--] [--------------------------------------------------------(U)-----|
|   4                                                          813    |
|[3]                                                                  |
B3/813 - ] [ - File #2 MAIN_PRGRM - 626
        -(L)- - File #2 MAIN_PRGRM - 630
```

405

-(U)- - File #2 MAIN_PRGRM - 632

Rung #633

```
|                                                                     |
|AUTO     HEATER 1                                          CHAMBER   |
|MODE     CHAMBER                                           NOT AT    |
|ENABLE   =<250                                             VACUUM    |
|AUTO     MICRONS                                           NO_VACUUM |
| N7:37   PIR2                                                 B3     |
|          I:004                                                      |
|--| |----+--|/|--+--------------------------------------------(L)----|
|   11    |   10  |                                             812   |
|[158]    |       |                                                   |
|         |CHROME | B3/812 - -| |- - File #2 MAIN_PRGRM - 626         |
|         |CHAMBER|          -(U)- - File #2 MAIN_PRGRM - 634         |
|         |=<250  |                                                   |
|         |MICRONS|                                                   |
|         |PIR6   |                                                   |
|         |  I:024|                                                   |
|         |--|/|--|                                                   |
|         |   07  |                                                   |
|         |MAGNETIC                                                   |
|         |CHAMBER|                                                   |
|         |=<250  |                                                   |
|         |MICRONS|                                                   |
|         |PIR11  |                                                   |
|         |  I:040|                                                   |
|         |--|/|--|                                                   |
|         |   07  |                                                   |
|         |CARBON |                                                   |
|         |CHAMBER|                                                   |
|         |=<250  |                                                   |
|         |MICRONS|                                                   |
|         |PIR16  |                                                   |
|         |  I:054|                                                   |
|         |--|/|--|                                                   |
|         |   07  |                                                   |
|         |EXIT BUFFER                                                |
|         |CHAMBER|                                                   |
|         |=<250  |                                                   |
|         |MICRONS|                                                   |
|         |PIR15  |                                                   |
|         |  I:040|                                                   |
|         +--|/|--+                                                   |
|            13                                                       |
```

Rung #634

```
|                                                         CHAMBER   |
|PAUSE                                                    NOT AT    |
|DISABLE                                                  VACUUM    |
|TS12                                                     NO_VACUUM |
| N7:16                                                      B3     |
|--| |---------------------------------------------------------(U)---|
|   4                                                         812   |
|[3]                                                                |
```

B3/812 - -| |- - File #2 MAIN_PRGRM - 626
-(L)- - File #2 MAIN_PRGRM - 633
-(U)- - File #2 MAIN_PRGRM - 634

```
Rung #635
|                                                                              |
|        PALLET      PALLET                                                    |
|PAUSE   DETECTED    DETECTED                                 PAUSE PALLET     |
|LATCH   LEFT SIDE   RIGHT SIDE                               IN ENTRANCE      |
|ENABLE  ENTRANCE    ENTRANCE                                 MOTOR 3          |
|PLE     SEN1        SEN3                                     M3PLL            |
| N7:37     I:003       I:003                                         B3      |
|--| |--------| |---------| |------------------------------------------(L)-----|
|  3         00          02                                           473      |
|[628]                                                                         |
B3/473 - -|/|- - File #2 MAIN_PRGRM -  185,187
         -(L)- - File #2 MAIN_PRGRM -  635
         -(U)- - File #2 MAIN_PRGRM -  628
Rung #636
|       PALLET      PALLET                                   PAUSE             |
|PAUSE  DETECTED    DETECTED                                 PALLET IN         |
|LATCH  LEFT SIDE   RIGHT SIDE                               LLOCK             |
|ENABLE LOADLOCK    LOADLOCK                                 MOTOR 4           |
|PLE    SEN4        SEN6                                     M4PLL             |
| N7:37     I:003       I:003                                         B3      |
|--| |--------| |---------| |------------------------------------------(L)-----|
|  3         03          05                                           401      |
|[628]                                                                         |
B3/401 - -|/|- - File #2 MAIN_PRGRM -  190,192
         -(L)- - File #2 MAIN_PRGRM -  636
         -(U)- - File #2 MAIN_PRGRM -  628
 .ng #637
|       PALLET      PALLET                                   PAUSE             |
|PAUSE  DETECTED    DETECTED                                 PALLET IN         |
|LATCH  LEFT SIDE   RIGHT SIDE                               HEATER 1          |
|ENABLE HEATER 1    HEATER 1                                 MOTOR 5           |
|PLE    SEN7        SEN9                                     M5PH1             |
| N7:37     I:003       I:003                                         B3      |
|--| |--------| |---------| |------------------------------------------(L)-----|
|  3         06          10                                           402      |
|[628]                                                                         |
B3/402 - -|/|- - File #2 MAIN_PRGRM -  195,195,197
         -(L)- - File #2 MAIN_PRGRM -  637
         -(U)- - File #2 MAIN_PRGRM -  628
Rung #638
|       PALLET      PALLET                                                     |
|PAUSE  DETECTED    DETECTED                                                   |
|LATCH  LEFT SIDE   RIGHT SIDE                               STOP MOTOR 6      |
|ENABLE HEATER 1    HEATER 1                                 PAUSE LATCH       |
|PLE    SEN7        SEN9                                     M6PL              |
| N7:37     I:003       I:003                                         B3      |
|--| |--------| |---------| |------------------------------------------(L)-----|
!  3         06          10                                           474      |
  .8]                                                                          |
B3/474 - -|/|- - File #2 MAIN_PRGRM -  218
         -(L)- - File #2 MAIN_PRGRM -  638
         -(U)- - File #2 MAIN_PRGRM -  629
Rung #639
|       PALLET      PALLET                                   PAUSE             |
|PAUSE  DETECTED    DETECTED                                 PALLET IN         |
|LATCH  LEFT SIDE   RIGHT SIDE                               DWELL 1           |
|ENABLE DWELL 1     DWELL 1                                  MOTOR 7           |
|PLE    SEN13       SEN15                                    M7PD1             |
| N7:37     I:003       I:003                                         B3      |
|--| |--------| |---------| |------------------------------------------(L)-----|
|  3         14          16                                           403      |
|[628]                                                                         |
```

```
B3/403 - -|/|- - File #2 MAIN_PRGRM -  231,231,233
         -(L)- - File #2 MAIN_PRGRM -  639
         -(U)- - File #2 MAIN_PRGRM -  628
Rung #640
|        PALLET     PALLET                                                      PAUSE       |
|PAUSE   DETECTED   DETECTED                                                    PALLET IN   |
|LATCH   LEFT SIDE  RIGHT SIDE                                                  DWELL 2     |
|ENABLE  DWELL 2    DWELL 2                                                     MOTOR 9     |
|PLE     SEN19      SEN21                                                       M9PD2       |
| N7:37     I:023      I:023                                                      B3       |
|-] [--------] [--------] [---------------------------------------------------------(L)-----|
|  3          03         05                                                        404      |
|[628]                                                                                      |
B3/404 - -|/|- - File #2 MAIN_PRGRM -  253,255
         -(L)- - File #2 MAIN_PRGRM -  640
         -(U)- - File #2 MAIN_PRGRM -  628
Rung #641
|        PALLET     PALLET                                                                  |
|PAUSE   DETECTED   DETECTED                                                                |
|LATCH   LEFT SIDE  RIGHT SIDE                                                STOP MOTOR 10 |
|ENABLE  DWELL 2    DWELL 2                                                   PAUSE LATCH   |
|PLE     SEN19      SEN21                                                     M10PL         |
| N7:37     I:023      I:023                                                      B3       |
|-] [--------] [--------] [---------------------------------------------------------(L)-----|
|  3          03         05                                                        475      |
|[628]                                                                                      |
B3/475 - -|/|- - File #2 MAIN_PRGRM -  258
         -(L)- - File #2 MAIN_PRGRM -  641
         -(U)- - File #2 MAIN_PRGRM -  629
Rung #642
|        PALLET     PALLET                                                      PAUSE       |
|PAUSE   DETECTED   DETECTED                                                    PALLET IN   |
|LATCH   LEFT SIDE  RIGHT SIDE                                                  DWELL 3     |
|ENABLE  DWELL 3    DWELL 3                                                     MOTOR 11    |
|PLE     SEN25      SEN27                                                       M11PD3      |
| N7:37     I:023      I:023                                                      B3       |
|-] [--------] [--------] [---------------------------------------------------------(L)-----|
|  3          11         13                                                        405      |
|[628]                                                                                      |
B3/405 - -|/|- - File #2 MAIN_PRGRM -  263,265
         -(L)- - File #2 MAIN_PRGRM -  642
         -(U)- - File #2 MAIN_PRGRM -  628
Rung #643
|        PALLET     PALLET     PALLET                                           PAUSE       |
|PAUSE   DETECTED   DETECTED   DETECTED                                         PALLET IN   |
|LATCH   LEFT SIDE  RIGHT SIDE CENTER                                           DWELL 4     |
|ENABLE  DWELL 4    DWELL 4    MAGNETIC                                         MOTOR 13    |
|PLE     SEN31      SEN33      SEN29                                            M13PD4      |
| N7:37     I:037      I:037      I:037                                           B3       |
|-] [--------] [--------] [--------]/[----------------------------------------------(L)-----|
|  3          03         05         01                                             406      |
|[628]                                                                                      |
B3/406 - -|/|- - File #2 MAIN_PRGRM -  285,287
         -(L)- - File #2 MAIN_PRGRM -  643
         -(U)- - File #2 MAIN_PRGRM -  628
```

```
Rung  #644
 |        PALLET     PALLET                                                                                  |
 |PAUSE   DETECTED   DETECTED                                                                                |
 |LATCH   LEFT SIDE  RIGHT SIDE                                                              STOP MOTOR 14   |
 |ENABLE  DWELL 4    DWELL 4                                                                 PAUSE LATCH     |
 |PLE     SEN31      SEN33                                                                   M14PL           |
 | N7:37      I:037      I:037                                                                   B3          |
 |-| |--------| |--------| |---------------------------------------------------------------------(L)---------|
 |  3         03         05                                                                      476         |
 |[628]                                                                                                      |
B3/476 - -|/|- - File #2 MAIN_PRGRM -  290
         -(L)- - File #2 MAIN_PRGRM -  644
         -(U)- - File #2 MAIN_PRGRM -  629
Rung  #645
 |        PALLET     PALLET                                                                  PAUSE           |
 |PAUSE   DETECTED   DETECTED                                                                PALLET IN       |
 |LATCH   LEFT SIDE  RIGHT SIDE                                                              DWELL 5         |
 |ENABLE  DWELL 5    DWELL 5                                                                 MOTOR 15        |
 |PLE     SEN37      SEN39                                                                   M15PD5          |
 | N7:37      I:037      I:037                                                                   B3          |
 |-| |--------| |--------| |---------------------------------------------------------------------(L)---------|
 |  3         11         13                                                                      407         |
 |[628]                                                                                                      |
B3/407 - -|/|- - File #2 MAIN_PRGRM -  295,297
         -(L)- - File #2 MAIN_PRGRM -  645
         -(U)- - File #2 MAIN_PRGRM -  628
 .ng  #646
 |        PALLET     PALLET     PALLET                                                       PAUSE           |
 |PAUSE   DETECTED   DETECTED   DETECTED                                                     PALLET IN       |
 |LATCH   LEFT SIDE  RIGHT SIDE CENTER                                                       DWELL 6         |
 |ENABLE  DWELL 6    DWELL 6    CARBON                                                       MOTOR 17        |
 |PLE     SEN43      SEN45      SEN41                                                        M17PD6          |
 | N7:37      I:053      I:053      I:053                                                        B3          |
 |-| |--------| |--------| |--------|/|------------------------------------------------------------(L)---------|
 |  3         03         05         01                                                           408         |
 |[628]                                                                                                      |
B3/408 - -|/|- - File #2 MAIN_PRGRM -  310,312
         -(L)- - File #2 MAIN_PRGRM -  646
         -(U)- - File #2 MAIN_PRGRM -  628
Rung  #647
 |        PALLET     PALLET                                                                                  |
 |PAUSE   DETECTED   DETECTED                                                                                |
 |LATCH   LEFT SIDE  RIGHT SIDE                                                              STOP MOTOR 18   |
 |ENABLE  DWELL 6    DWELL 6                                                                 PAUSE LATCH     |
 |PLE     SEN43      SEN45                                                                   M18PL           |
 | N7:37      I:053      I:053                                                                   B3          |
 |-| |--------| |--------| |---------------------------------------------------------------------(L)---------|
 |  3         03         05                                                                      477         |
   28]                                                                                                       |
B3/477 - -|/|- - File #2 MAIN_PRGRM -  315
         -(L)- - File #2 MAIN_PRGRM -  647
         -(U)- - File #2 MAIN_PRGRM -  629
Rung  #648
 |        PALLET     PALLET                                                                  PAUSE           |
 |PAUSE   DETECTED   DETECTED                                                                PALLET IN       |
 |LATCH   LEFT SIDE  RIGHT SIDE                                                              EXITBUFFER      |
 |ENABLE  EXBUFFER   EXBUFFER                                                                MOTOR 19        |
 |PLE     SEN49      SEN51                                                                   M19PXB          |
 | N7:37      I:053      I:053                                                                   B3          |
 |-| |--------| |--------| |---------------------------------------------------------------------(L)---------|
 |  3         11         13                                                                      409         |
 |[628]                                                                                                      |
```

```
B3/409 - -|/|- - File #2 MAIN_PRGRM -  320,322
         -(L)- - File #2 MAIN_PRGRM -  648
         -(U)- - File #2 MAIN_PRGRM -  628
```

Rung #649

```
|       PALLET    PALLET                                         PAUSE PALLET |
|PAUSE  DETECTED  DETECTED                                       EXITLOCK     |
|LATCH  LEFT SIDE RIGHT SIDE                                     MOTOR 20     |
|ENABLE EXIT LOCK EXLOCK                                         PAUSE        |
|PLE    SEN52     SEN54                                          M20PXL       |
| N7:37    I:053     I:053                                            B3      |
|-| |------| |-------| |-------------------------------------------------(L)---|
|  3        14        16                                             490      |
|[628]                                                                        |
B3/490 - -|/|- - File #2 MAIN_PRGRM -  331,333
         -(L)- - File #2 MAIN_PRGRM -  649
         -(U)- - File #2 MAIN_PRGRM -  628
```

Rung #650

```
|       PALLET    PALLET                                         PAUSE        |
|PAUSE  DETECTED  DETECTED                                       PALLET AT    |
|LATCH  LEFT SIDE RIGHT SIDE                                     EXIT         |
|ENABLE EXIT END  EXIT END                                       MOTOR 21     |
|PLE    SEN55     SEN57                                          M21PPX       |
| N7:37    I:053     I:054                                            B3      |
|-| |------| |-------| |-------------------------------------------------(L)---|
|  3        17        17                                             410      |
|[628]                                                                        |
 '410 - -|/|- - File #2 MAIN_PRGRM -  355,357
        -(L)- - File #2 MAIN_PRGRM -  650
        -(U)- - File #2 MAIN_PRGRM -  628
```

Rung #651

```
|LLOCK                                                                        |
|CHAMBER                                                          SCREEN      |
|PRESSUR AT                                                       AREA 1      |
|ATMOSPHERE                                                       VENTED      |
|PS2                                                              V1DN        |
|   I:002                                                            B3       |
|------| |----------------------------------------------------------(L)------|
|      04                                                           821       |
B3/821 - -(L)- - File #2 MAIN_PRGRM -  651
         -(U)- - File #2 MAIN_PRGRM -  652
```

Rung #652

```
|HEATER 1                                                                     |
|CHAMBER                                                          SCREEN      |
|=<250                                                            AREA 1      |
|MICRONS                                                          VENTED      |
|PIR2                                                             V1DN        |
|  I:004                                                             B3       |
|------| |----------------------------------------------------------(U)------|
       10                                                           821       |
B3/821 - -(L)- - File #2 MAIN_PRGRM -  651
         -(U)- - File #2 MAIN_PRGRM -  652
```

Rung #653

```
|DWELL 1                                                                      |
|CHAMBER                                                          SCREEN      |
|PRESSUR AT                                                       AREA 1      |
|ATMOSPHERE                                                       VENTED      |
|PS3                                                              V2DN        |
|   I:002                                                            B3       |
|------| |----------------------------------------------------------(L)------|
|      05                                                           822       |
B3/822 - -(L)- - File #2 MAIN_PRGRM -  653
         -(U)- - File #2 MAIN_PRGRM -  654
```

```
Rung #654
|CHROME                                                                  |
|CHAMBER                                                         SCREEN  |
|=<250                                                           AREA 1  |
|MICRONS                                                         VENTED  |
|PIR6                                                            V2DN    |
|  I:024                                                            B3   |
|----] [---------------------------------------------------------(U)----|
|    07                                                             822  |
B3/822 - -(L)- - File #2 MAIN_PRGRM -  653
         -(U)- - File #2 MAIN_PRGRM -  654
Rung #655
|DWELL 3                                                                 |
|CHAMBER                                                         SCREEN  |
|PRESSUR AT                                                      AREA 3  |
|ATMOSPHERE                                                      VENTED  |
|PS4                                                             V3DN    |
|  I:022                                                            B3   |
|----] [---------------------------------------------------------(L)----|
|    04                                                             823  |
B3/823 - -(L)- - File #2 MAIN_PRGRM -  655
         -(U)- - File #2 MAIN_PRGRM -  656
Rung #656
|MAGNETIC                                                                |
|CHAMBER                                                         SCREEN  |
|=<250                                                           AREA 3  |
  CRONS                                                          VENTED  |
|PIR11                                                           V3DN    |
|  I:040                                                            B3   |
|----] [---------------------------------------------------------(U)----|
|    07                                                             823  |
B3/823 - -(L)- - File #2 MAIN_PRGRM -  655
         -(U)- - File #2 MAIN_PRGRM -  656
Rung #657
|DWELL 5                                                                 |
|CHAMBER                                                         SCREEN  |
|PRESSUR AT                                                      AREA 4  |
|ATMOSPHERE                                                      VENTED  |
|PS5                                                             V4DN    |
|  I:036                                                            B3   |
|----] [---------------------------------------------------------(L)----|
|    04                                                             824  |
B3/824 - -(L)- - File #2 MAIN_PRGRM -  657
         -(U)- - File #2 MAIN_PRGRM -  658
Rung #658
|CARBON                                                                  |
|CHAMBER                                                         SCREEN  |
|=<250                                                           AREA 4  |
  CRONS                                                          VENTED  |
|PIR16                                                           V4DN    |
|  I:054                                                            B3   |
|----] [---------------------------------------------------------(U)----|
|    07                                                             824  |
B3/824 - -(L)- - File #2 MAIN_PRGRM -  657
         -(U)- - File #2 MAIN_PRGRM -  658
Rung #659
|EXLOCK                                                                  |
|CHAMBER                                                         SCREEN  |
|PRESSUR AT                                                      AREA 5  |
|ATMOSPHERE                                                      VENTED  |
|PS6                                                             V5DN    |
|  I:052                                                            B3   |
|----] [---------------------------------------------------------(L)----|
>                                                                        >
```

```
<                                                                       <
| 04                                                                825 |
B3/825 - -(L)- - File #2 MAIN_PRGRM - 659
        -(U)- - File #2 MAIN_PRGRM - 660
Rung #660
|EXIT BUFFER                                                            |
|CHAMBER                                                         SCREEN |
|=<250                                                           AREA 5 |
|MICRONS                                                        VENTED |
|PIR15                                                            V5DN  |
|   I:040                                                          B3   |
|---] [------------------------------------------------------------(U)--|
|    13                                                            825  |
B3/825 - -(L)- - File #2 MAIN_PRGRM - 659
        -(U)- - File #2 MAIN_PRGRM - 660
Rung #661
|HEATER 1                                                               |
|CHAMBER                                                         SCREEN |
|=<250                                                           AREA 1 |
|MICRONS                                                         PUMPED |
|PIR2                                                             P1DN  |
|  I:004                                                           B3   |
|---] [------------------------------------------------------------(L)--|
|   10                                                             826  |
B3/826 - -(L)- - File #2 MAIN_PRGRM - 661
        -(U)- - File #2 MAIN_PRGRM - 662
ng #662
|LLOCK                                                                  |
|CHAMBER                                                         SCREEN |
|PRESSUR AT                                                      AREA 1 |
|ATMOSPHERE                                                      PUMPED |
|PS2                                                              P1DN  |
|  I:002                                                           B3   |
|---] [------------------------------------------------------------(U)--|
|   04                                                             826  |
B3/826 - -(L)- - File #2 MAIN_PRGRM - 661
        -(U)- - File #2 MAIN_PRGRM - 662
Rung #663
|CHROME                                                                 |
|CHAMBER                                                         SCREEN |
|=<250                                                           AREA 2 |
|MICRONS                                                         PUMPED |
|PIR6                                                             P2DN  |
|  I:024                                                           B3   |
|---] [------------------------------------------------------------(L)--|
|   07                                                             827  |
B3/827 - -(L)- - File #2 MAIN_PRGRM - 663
        -(U)- - File #2 MAIN_PRGRM - 664
ng #664
|DWELL 1                                                                |
|CHAMBER                                                         SCREEN |
|PRESSUR AT                                                      AREA 2 |
|ATMOSPHERE                                                      PUMPED |
|PS3                                                              P2DN  |
|  I:002                                                           B3   |
|---] [------------------------------------------------------------(U)--|
|   05                                                             827  |
B3/827 - -(L)- - File #2 MAIN_PRGRM - 663
        -(U)- - File #2 MAIN_PRGRM - 664
```

```
Rung #665
|MAGNETIC                                                        |
|CHAMBER                                                  SCREEN |
|=<250                                                    AREA 3 |
|MICRONS                                                  PUMPED |
|PIR11                                                    P3ON   |
|  I:040                                                    B3   |
|---] [---------------------------------------------------(L)----|
|    07                                                    828   |
B3/828 - -(L)- - File #2 MAIN_PRGRM -  665
         -(U)- - File #2 MAIN_PRGRM -  666
Rung #666
|DWELL 3                                                         |
|CHAMBER                                                  SCREEN |
|PRESSUR AT                                               AREA 3 |
|ATMOSPHERE                                               PUMPED |
|PS4                                                      P3ON   |
|   I:022                                                   B3   |
|---] [---------------------------------------------------(U)----|
|    04                                                    828   |
B3/828 - -(L)- - File #2 MAIN_PRGRM -  665
         -(U)- - File #2 MAIN_PRGRM -  666
Rung #667
|CARBON                                                         |
|CHAMBER                                                  SCREEN |
|=<250                                                    AREA 4 |
  :RONS                                                   PUMPED |
|PIR16                                                    P4ON   |
|  I:054                                                    B3   |
|---] [---------------------------------------------------(L)----|
|    07                                                    829   |
B3/829 - -(L)- - File #2 MAIN_PRGRM -  667
         -(U)- - File #2 MAIN_PRGRM -  668
Rung #668
|DWELL 5                                                         |
|CHAMBER                                                  SCREEN |
|PRESSUR AT                                               AREA 4 |
|ATMOSPHERE                                               PUMPED |
|PS5                                                      P4ON   |
|   I:036                                                   B3   |
|---] [---------------------------------------------------(U)----|
|    04                                                    829   |
B3/829 - -(L)- - File #2 MAIN_PRGRM -  667
         -(U)- - File #2 MAIN_PRGRM -  668
Rung #669
|EXIT BUFFER                                                     |
|CHAMBER                                                  SCREEN |
|=<250                                                    AREA 5 |
  :RONS                                                   PUMPED |
|PIR15                                                    P5ON   |
|    I:040                                                  B3   |
|-----] [-------------------------------------------------(L)----|
|      13                                                  830   |
B3/830 - -(L)- - File #2 MAIN_PRGRM -  669
         -(U)- - File #2 MAIN_PRGRM -  670
Rung #670
|EXLOCK                                                          |
|CHAMBER                                                  SCREEN |
|PRESSUR AT                                               AREA 5 |
|ATMOSPHERE                                               PUMPED |
|PS6                                                      P5ON   |
|   I:052                                                   B3   |
|---] [---------------------------------------------------(U)----|
>                                                                >
```

```
<
|     04                                                              830  |
B3/830 - -(L)- - File #2 MAIN_PRGRM -  669
         -(U)- - File #2 MAIN_PRGRM -  670
Rung #671
|MECHANICAL                                                                 |
|PUMP 2                                                                     |
|TC=<50                                                    LINE PRESSURE    |
|MICRONS                                                   MADE-TC10        |
|PIR10                                                     LPM-TC10         |
|  I:024                                                        B3          |
|---] [-------------------------------------------------------(L)----------|
|   13                                                          250         |
B3/250 - -] [- - File #3 CRYO_REGEN -  15,164,165,166,167,168,169,170,171,172,173,174
                 File #6 TECH_RUNGS -  15
         -(L)- - File #2 MAIN_PRGRM -  671
         -(U)- - File #2 MAIN_PRGRM -  673
Rung #672
|MECHANICAL                                                                 |
|PUMP 2                                                                     |
|TC=<50                                              TC10 FAULT             |
|MICRONS                                             DELAY TIMER            |
|PIR10                                               TC10FDT                |
|  I:024                                             +--TON--------------+  |
|---]/[----------------------------------------------+TIMER ON DELAY     +-(EN)-|
   13                                                |TIMER:       T4:70|  |
                                                     |BASE (SEC):   1.0+-(DN) |
| T4:70.DN - -] [- - File #2 MAIN_PRGRM - 673        |PRESET:         60|  |
|                                                    |ACCUM:          60|  |
|                                                    +-------------------+  |
Rung #673
|TC10                                                      LINE PRESSURE    |
|TIMEOUT                                                   MADE-TC10        |
|TC10FDT                                                   LPM-TC10         |
|  T4:70                                                        B3          |
|---] [-------------------------------------------------------(U)----------|
|   DN                                                          250         |
|[672]                                                                      |
B3/250 - -] [- - File #3 CRYO_REGEN -  15,164,165,166,167,168,169,170,171,172,173,174
                 File #6 TECH_RUNGS -  15
         -(L)- - File #2 MAIN_PRGRM -  671
         -(U)- - File #2 MAIN_PRGRM -  673
Rung #674
|                                                LLOCK                      |
|VENT         AUTO           PUMP-VENT           CHAMBER                    |
|LOAD LOCK    MODE           CYCLE LOAD PUMPDOWN PRESSUR AT       VENT      |
|PUSHBUTTON   ENABLE         LOCK       LOADLOCK ATMOSPHERE       LOAD LOCK |
|VNTLLPB      AUTO           PD-VNT-LL  PDLL     PS2              VNT_LL    |
|  N7:3       N7:37             N7:24    N7:24    I:002             N7:24   |
|---] [-----+--]/[--------+----]/[------]/[------]/[----------------(L)-----|
|    13     |   11        |     14       15       04                 13     |
|[3]        |[158]        | [676]      [684]                                |
|           |PALLET    PALLET     |                                         |
|           |DETECTED  DETECTED   |                                         |
|           |CENTER    RIGHT SIDE |                                         |
|           |LOADLOCK  LOADLOCK   |                                         |
|           |SEN5      SEN6       |                                         |
|           |  I:003     I:003    |                                         |
|           +---]/[------]/[------+                                         |
|                04         05                                              |
N7:24/13 - -] [- - File #2 MAIN_PRGRM -  166,173,202,675
           -]/[- - File #2 MAIN_PRGRM -  676,684
```

```
          -(L)- - File #2 MAIN_PRGRM -  674
          -(U)- - File #2 MAIN_PRGRM -  675
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM -  2
Rung #675
|           LLOCK       OPEN                                                                  |
|           CHAMBER     LOAD LOCK                                                             |
| VENT      PRESSUR AT  CHAMBER                                                       VENT    |
| LOAD LOCK ATMOSPHERE  VENT VALVE                                                    LOAD LOCK|
| VNT_LL    PS2         CV1                                                           VNT_LL  |
|  N7:24     I:002       O:007                                                         N7:24  |
|-+--| |-------| |-------|/|-----+--------------------------------------------------------(U)---|
| |   13        04        16     |                                                       13    |
| |[675]                 [177]   |                                                             |
| |                              | N7:24/13 - -| |- - File #2 MAIN_PRGRM - 166, 173, 202, 675  |
| |                              |            -|/|- - File #2 MAIN_PRGRM - 676, 684           |
| |                              |            -(L)- - File #2 MAIN_PRGRM - 674                |
| |                              | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                 |
| |PUMPDOWN                      |                                                             |
| |LOADLOCK                      |                                                             |
| |PDLL                          |                                                             |
| | N7:24                        |                                                             |
| |--| |-----------------------+                                                             |
| |   15                         |                                                             |
| |[684]                         |                                                             |
| |PAUSE                         |                                                             |
| |DISABLE                       |                                                             |
|  TS12                          |                                                             |
| | N7:16                        |                                                             |
| +--| |-----------------------+                                                             |
|     4                                                                                        |
|  [3]                                                                                         |
Rung #676
|VENT-PUMP                                          LLOCK                                      |
|CYCLE LOAD  AUTO                                   CHAMBER                        PUMP-VENT   |
|LOCK        MODE              VENT      PUMPDOWN   PRESSUR AT                     CYCLE LOAD  |
|PUSHBUTTON  ENABLE            LOAD LOCK LOADLOCK   ATMOSPHERE                     LOCK        |
|V-P-LLPB    AUTO              VNT_LL    PDLL       PS2                            PD-VNT-LL   |
|   N7:3      N7:37              N7:24     N7:24     I:002                           N7:24     |
|----| |---+---|/|----------+----|/|-------|/|-------| |------------------------------(L)-------|
|     14   |    11          |     13        15        04                              14       |
|[3]       |[158]           | [675]      [684]                                                 |
|          |PALLET   PALLET |                                                                  |
|          |DETECTED DETECTED|                                                                 |
|          |CENTER   RIGHT SIDE|                                                               |
|          |LOADLOCK LOADLOCK|                                                                 |
|          |SENS     SEN6   |                                                                  |
|          | I:003    I:003 |                                                                  |
|          +--|/|------|/|--+                                                                  |
               04       05
N7:24/14 - -| |- - File #2 MAIN_PRGRM -  68,166,181,677,678,679,680,681,682
           -|/|- - File #2 MAIN_PRGRM -  674,683,684
           -(L)- - File #2 MAIN_PRGRM -  676
           -(U)- - File #2 MAIN_PRGRM -  677
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM -  2
```

```
Rung #677
| PUMP-VENT                                                                     PUMP-VENT  |
| CYCLE LOAD  DOOR 1                                                            CYCLE LOAD |
| LOCK        OPEN                                                              LOCK       |
| PD-VNT-LL   DROP1S                                                            PD-VNT-LL  |
|    N7:24     I:006                                                             N7:24     |
|--+----] [-------] [----+--------------------------------------------------------(U)------|
|  |     14        01    |                                                         14      |
|  |[677]                |                                                                 |
|  |                     | N7:24/14 - -] [- - File #2 MAIN_PRGRM - 68, 166, 181, 677, 678, 679, 680, 681, 682
|  |                     |            -]/[- - File #2 MAIN_PRGRM - 674, 683, 684           |
|  |                     |            -(L)- - File #2 MAIN_PRGRM - 676                     |
|  |                     | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                     |
|  |PAUSE                |                                                                 |
|  |DISABLE              |                                                                 |
|  |TS12                 |                                                                 |
|  |  N7:16              |                                                                 |
|  +----] [--------------+                                                                 |
|        4                                                                                  |
|  [3]                                                                                      |
Rung #678
|                                              LLOCK       VENT                   PUMPDOWN |
|PUMP-VENT                                     CHAMBER     LOADLOCK               LOADLOCK |
|CYCLE LOAD  DOOR 1  DOOR 2  THREE CYCLES      PRESSUR AT  CLEAN                  CLEAN    |
|LOCK        CLOSED  CLOSED  COMPLETE          ATMOSPHERE  CYCLE                  CYCLE    |
|PD-VNT-LL   DRCL1S  DRCL2S  LL-CCC            PS2         VNT-LL-CC              PD-LL-CC |
|  N7:24     I:006   I:006       C5:9          I:002         B3                     B3     |
|---] [-------] [-----] [----------]/[----------] [----------]/[---------------------(L)---|
|    14        00      02          DN           04           145                    144    |
|[677]                        [682]                         [680]                          |
B3/144 - -] [- - File #2 MAIN_PRGRM -  167,202
         -]/[- - File #2 MAIN_PRGRM -  167
         -(L)- - File #2 MAIN_PRGRM -  678
         -(U)- - File #2 MAIN_PRGRM -  679
Rung #679
|                                                                                 PUMPDOWN |
| PUMP-VENT   LOAD LOCK                                                           LOADLOCK |
| CYCLE LOAD  CHAMBER =<250                                                       CLEAN    |
| LOCK        MICRONS                                                             CYCLE    |
| PD-VNT-LL   PIR1                                                                PD-LL-CC |
|    N7:24      I:004                                                               B3     |
|--+----] [-------] [----+----------------------------------------------------------(U)---|
|  |     14        07    |                                                          144    |
|  |[677]                |                                                                 |
|  |                     | B3/144 - -] [- - File #2 MAIN_PRGRM - 167, 202                  |
|  |                     |          -]/[- - File #2 MAIN_PRGRM - 167                       |
|  |                     |          -(L)- - File #2 MAIN_PRGRM - 678                       |
|  |PAUSE                |                                                                 |
|  |DISABLE              |                                                                 |
|  |TS12                 |                                                                 |
|  |  N7:16              |                                                                 |
|  +----] [--------------+                                                                 |
|        4                                                                                  |
|  [3]                                                                                      |
```

```
Rung #680
|                                                                              VENT        |
|                         LLOCK                                                LOADLOCK    |
|PUMP-VENT   LOAD LOCK   CHAMBER                                              CLEAN       |
|CYCLE LOAD  CHAMBER =<250 PRESSUR AT THREE CYCLES                            CYCLE       |
|LOCK        MICRONS     ATMOSPHERE  COMPLETE                                 VNT-LL-CC   |
|PD-VNT-LL   PIR1        PS2         LL-CCC                                      B3       |
|  N7:24       I:004       I:002       C5:9                                               |
|---] [----------]/[---------]/[---------]/[-------------------------------------(L)------|
|     14          07          04          DN                                    145       |
|[677]                               [682]                                                |
B3/145 - ] [ - File #2 MAIN_PRGRM - 173
         ]/[ - File #2 MAIN_PRGRM - 678,682
         (L) - File #2 MAIN_PRGRM - 680
         (U) - File #2 MAIN_PRGRM - 681
Rung #681
|                                                                              VENT        |
|            OPEN        LLOCK                                                LOADLOCK    |
| PUMP-VENT  LOAD LOCK   CHAMBER                                              CLEAN       |
| CYCLE LOAD CHAMBER     PRESSUR AT                                           CYCLE       |
| LOCK       VENT VALVE  ATMOSPHERE                                           VNT-LL-CC   |
| PD-VNT-LL  CV1         PS2                                                     B3       |
|   N7:24      O:007       I:002                                                          |
|-+---] [----------]/[---------] [---+-----------------------------------------(U)------|
| |    14          16          04    |                                          145       |
| |[677]        [177]                |                                                    |
| |                                  | B3/145 - ] [ - File #2 MAIN_PRGRM - 173            |
| |                                  |          ]/[ - File #2 MAIN_PRGRM - 678, 682       |
|                                    |          (L) - File #2 MAIN_PRGRM - 680            |
| |PAUSE                             |                                                    |
| |DISABLE                           |                                                    |
| |TS12                              |                                                    |
| |  N7:16                           |                                                    |
| +---] [----------------------------+                                                    |
|      4                                                                                   |
|  [3]                                                                                     |
Rung #682
|           VENT        LLOCK                                                              |
|PUMP-VENT  LOADLOCK    CHAMBER                                  LOAD LOCK                 |
|CYCLE LOAD CLEAN       PRESSUR AT                               CLEAN CYCLE               |
|LOCK       CYCLE       ATMOSPHERE                               COUNTER                   |
|PD-VNT-LL  VNT-LL-CC   PS2                                      LL-CCC                    |
|  N7:24       B3        I:002                                   +--CTU-----------+        |
|---] [---------]/[---------] [----------------------------------+COUNT UP        +-(CU)-|
|     14        145        04                                     |COUNTER:   C5:9|        |
|[677]       [681]                                               |PRESET:       4+-(DN)  |
|                                                                |ACCUM:        0|        |
|                                                                +----------------+        |
C5:9 - CTU - File #2 MAIN_PRGRM - 682
       RES - File #2 MAIN_PRGRM - 683
 :9.DN - ] [ - File #2 MAIN_PRGRM - 181
         ]/[ - File #2 MAIN_PRGRM - 678,680
```

```
Rung #683
| PUMP-VENT                                                            LOAD LOCK  |
| CYCLE LOAD  DOOR 1                                                   CLEAN CYCLE|
| LOCK        OPEN                                                     COUNTER    |
| PD-VNT-LL   DROP1S                                                   LL-CCC     |
|   N7:24     I:006                                                      C5:9     |
|---]/[-------] [-----------------------------------------------------------[RES]--|
|    14        01   |                                                             |
| |[677]            |                                                             |
| |                 | C5:9 - CTU - File #2 MAIN_PRGRM - 682                       |
| |                 | C5:9.DN - -] [- - File #2 MAIN_PRGRM - 181                  |
| |                 |            -]/[- - File #2 MAIN_PRGRM - 678, 680            |
| |PAUSE            |                                                             |
| |DISABLE          |                                                             |
| |TS12             |                                                             |
| |  N7:16          |                                                             |
| |----] [----------|                                                             |
|       4                                                                         |
| [3]
Rung #684
| PUMP DOWN      AUTO                  LOAD LOCK     PIRANI                PUMP-VENT   LOAD LOCK                |
| LOAD LOCK      MODE          DOOR 2  CHAMBER =<250 GUAGE 1   VENT        CYCLE LOAD  CHAMBER =<250  PUMPDOWN |
| PUSH BUTTON    ENABLE        CLOSED  MICRONS       NO FAULT  LOAD LOCK   LOCK        MICRONS        LOADLOCK |
| PDLLPB         AUTO          DRCL2S  PIR1          PGNF1     VNT_LL      PD-VNT-LL   PIR1           PDLL     |
|   N7:3         N7:37         I:006     I:004       I:004     N7:24       N7:24       I:004          N7:24    |
|----] [------+---]/[-----+-----] [-------]/[---------] [--------]/[---------]/[----------]/[------------(L)----|
|      15     |     11    |      02        07          14         13          14          07            15     |
| |[3]        | |[158]    |                                    [675]       [677]                              |
| |           | |PALLET     PALLET                                                                            |
| |           | |DETECTED   DETECTED                                                                          |
| |VENT AREA  | |CENTER     RIGHT SIDE                                                                        |
| |1 ENABLE   | |LOADLOCK   LOADLOCK                                                                          |
| |VENT1E     | |SEN5       SEN6                                                                              |
| |  N7:37    | |  I:003      I:003                                                                           |
| |----] [----| |---]/[-------]/[---|                                                                       |
|       6           04         05                                                                         |
| [410]
N7:24/15 - -] [- - File #2 MAIN_PRGRM -  68,167,675,685,686
          -]/[- - File #2 MAIN_PRGRM -  167,674,676
          -(L)- - File #2 MAIN_PRGRM -  684
          -(U)- - File #2 MAIN_PRGRM -  687
_F:N7:211X21 - BTW - File #2 MAIN_PRGRM -  2
Rung #685
|PUMPDOWN                                                     ROUGH VALVE 1             |
|LOADLOCK                                                     OPEN DELAY                |
|PDLL                                                         RV1OP_DLY                 |
| N7:24                                                       +-TON-------------+       |
|---] [-------------------------------------------------------+TIMER ON DELAY   +-(EN)-|
|    15                                                       |TIMER:     T4:189|       |
| 684]                                                        |BASE (SEC):   1.0+-(DN)  |
|                                                             |PRESET:         5|       |
|                                                             |ACCUM:          0|       |
|                                                             +-----------------+       |
T4:189.DN - -] [- - File #2 MAIN_PRGRM -  167
```

Rung #491

```
|MANUAL
|CONTROL
|CRYO GATE                                                  MANUAL CRYO
|10 OPEN                                                    GATE 10 OPEN
|M-HV10-1                                                   MCG10OP
|  N7:4                                                       N7:25
|---| |-------------------------------------------------------+---(L)---+
|   14                                                        |   14    |
|[3]                                                          |         |
| N7:25/14 - -| |- - File #2 MAIN_PRGRM - 133, 134, 494       |         |
|            -(U)- - File #2 MAIN_PRGRM - 492                 |MANUAL CRYO
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                 |GATE 10 CLOSE
| N7:27/5 - -(L)- - File #2 MAIN_PRGRM - 492                  |MCG10CL
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                 |   N7:27
|                                                             +---(U)---+
|                                                                  5
```

Rung #492

```
|  MANUAL
|  CONTROL
|  CRYO GATE                                                MANUAL CRYO
|  10 CLOSE                                                 GATE 10 OPEN
|  M-HV10-0                                                 MCG10OP
|     N7:6                                                    N7:25
|-+---| |----+------------------------------------------------+---(U)---+
| |    5     |                                                |   14    |
| |[3]       |                                                |         |
|            | N7:25/14 - -| |- - File #2 MAIN_PRGRM - 133, 134, 494    |
| |          |            -(L)- - File #2 MAIN_PRGRM - 491      |         |
| |MANUAL    | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2      |MANUAL CRYO
| |CONTROL   | N7:27/5 - -(U)- - File #2 MAIN_PRGRM - 491       |GATE 10 CLOSE
| |CRYO GATE | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2      |MCG10CL
| |10THROTTLE|                                                  |   N7:27
| |M-HV10-2  |                                                  +---(L)---+
| |  N7:5    |                                                       5
| +---| |----+
| |    9     |
| |[3]       |
| |PREPARE FOR
| |AUTO RUN  |
| |>AUTO     |
| |   N7:37  |
| +---| |----+
| |    1     |
| |[162]     |
| |COMPRESSOR|
| |7 REGEN-  |
| |ERATION   |
| |PROGRAM   |
|  CYRGN7    |
| |   B3     |
| +---| |----+
|     327
|  [3:57]
```

```
Rung #493
|MANUAL
|CONTROL                                                                MANUAL CRYO |
|CRYO GATE                                                              GATE 10     |
|10THROTTLE                                                             THROTTLE    |
|M-HV10-2                                                               MCG10TL     |
|   N7:5                                                                   N7:26    |
|---| |-------------------------------------------------------------------(L)------|
|    9                                                                       9      |
|[3]
N7:26/9 - -| |- - File #2 MAIN_PRGRM -  134,134
          -(L)- - File #2 MAIN_PRGRM -  493
          -(U)- - File #2 MAIN_PRGRM -  494
_F:N7:21[X21 - BTW - File #2 MAIN_PRGRM -  2
Rung #494
| MANUAL
| CONTROL                                                               MANUAL CRYO |
| CRYO GATE                                                             GATE 10     |
| 10 CLOSE                                                              THROTTLE    |
| M-HV10-0                                                              MCG10TL     |
|    N7:6                                                                  N7:26    |
|-+-----| |----+----------------------------------------------------------(U)------|
| |      5     |                                                             9      |
| |[3]         |                                                                    |
| |            | N7:26/9 - -| |- - File #2 MAIN_PRGRM - 134                          |
| |            |           -(L)- - File #2 MAIN_PRGRM - 493                          |
| |            | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                          |
  MANUAL CRYO  |                                                                    |
| |GATE 10 OPEN|                                                                    |
| |MCG10OP     |                                                                    |
| |    N7:25   |                                                                    |
| |-----| |----|                                                                    |
| |      14    |                                                                    |
| |[492]       |                                                                    |
| |PREPARE FOR |                                                                    |
| |AUTO RUN    |                                                                    |
| |>AUTO       |                                                                    |
| |    N7:37   |                                                                    |
| |-----| |----|                                                                    |
| |      1     |                                                                    |
| |[162]       |                                                                    |
| |COMPRESSOR  |                                                                    |
| |7 REGEN-    |                                                                    |
| |ERATION     |                                                                    |
| |PROGRAM     |                                                                    |
| |CYRGN7      |                                                                    |
| |      B3    |                                                                    |
| +-----| |----+                                                                    |
|      327                                                                          |
   [3:57]                                                                           |
```

420

```
Rung #495
|MANUAL
|CONTROL
|CRYO GATE                                                         MANUAL CRYO
|11 OPEN                                                           GATE 11 OPEN
|M-HV11-1                                                          MCG11OP
|  N7:4                                                               N7:25
|---| |-----------------------------------------------------------+-----(L)-----+-
|   15                                                           |      15     |
|[3]                                                             |             |
| N7:25/15 - -| |- - File #2 MAIN_PRGRM - 135, 136, 498           |             |
|            -(U)- - File #2 MAIN_PRGRM - 496                    |MANUAL CRYO  |
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                     |GATE 11 CLOSE|
| N7:27/6 - -(L)- - File #2 MAIN_PRGRM - 496                     |MCG11CL      |
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                     |    N7:27    |
|                                                                +-----(U)-----+
|                                                                       6
Rung #496
|  MANUAL
|  CONTROL
|  CRYO GATE                                                       MANUAL CRYO
|  11 CLOSE                                                        GATE 11 OPEN
|  M-HV11-0                                                        MCG11OP
|     N7:6                                                            N7:25
|-+---| |------+---------------------------------------------------+-----(U)-----+-
| |     6      |                                                   |      15     |
| |[3]         |                                                   |             |
|              | N7:25/15 - -| |- - File #2 MAIN_PRGRM - 135, 136, 498           |
| |            |            -(L)- - File #2 MAIN_PRGRM - 495       |             |
| |MANUAL      | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2         |MANUAL CRYO  |
| |CONTROL     | N7:27/6 - -(U)- - File #2 MAIN_PRGRM - 495         |GATE 11 CLOSE|
| |CRYO GATE   | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2         |MCG11CL      |
| |11THROTTLE  |                                                   |    N7:27    |
| |M-HV11-2    |                                                   +-----(L)-----+
| |   N7:5     |                                                          6
| +---| |------+
| |   10       |
| |[3]         |
| |PREPARE FOR |
| |AUTO RUN    |
| |>AUTO       |
| |   N7:37    |
| +---| |------+
| |    1       |
| |[162]       |
| |COMPRESSOR  |
| |8 REGEN-    |
| |ERATION     |
| |PROGRAM     |
| |CYRGN8      |
| |    B3      |
| +---| |------+
|    328
|  [3:63]
```

```
Rung #497
|MANUAL
|CONTROL                                                                        MANUAL CRYO |
|CRYO GATE                                                                      GATE 11     |
|11THROTTLE                                                                     THROTTLE    |
|M-HV11-2                                                                       MCG11TL     |
|    N7:5                                                                          N7:26    |
|----] [------------------------------------------------------------------------(L)-------|
|     10                                                                           10       |
|[3]                                                                                        |
N7:26/10 - ] [ - File #2 MAIN_PRGRM -  136,136
           -(L)- - File #2 MAIN_PRGRM -  497
           -(U)- - File #2 MAIN_PRGRM -  498
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM -  2
Rung #498
| MANUAL
| CONTROL                                                                       MANUAL CRYO |
| CRYO GATE                                                                     GATE 11     |
| 11 CLOSE                                                                      THROTTLE    |
| M-HV11-0                                                                      MCG11TL     |
|    N7:6                                                                          N7:26    |
|-+----] [------+-----------------------------------------------------------------(U)-----|
| |      6      |                                                                  10       |
| |[3]          |                                                                           |
| |             | N7:26/10 - ] [ - File #2 MAIN_PRGRM - 136                                 |
| |             |            -(L)- - File #2 MAIN_PRGRM - 497                               |
| |             | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                               |
|  MANUAL CRYO  |                                                                           |
| |GATE 11 OPEN |                                                                           |
| |MCG11OP      |                                                                           |
| |   N7:25     |                                                                           |
| +----] [------+                                                                           |
| |     15      |                                                                           |
| |[496]        |                                                                           |
| |PREPARE FOR  |                                                                           |
| |AUTO RUN     |                                                                           |
| |>AUTO        |                                                                           |
| |   N7:37     |                                                                           |
| +----] [------+                                                                           |
| |     1       |                                                                           |
| |[162]        |                                                                           |
| |COMPRESSOR   |                                                                           |
| |8 REGEN-     |                                                                           |
| |ERATION      |                                                                           |
| |PROGRAM      |                                                                           |
| |CYRGN8       |                                                                           |
| |    B3       |                                                                           |
| +----] [------+                                                                           |
|     328                                                                                   |
  [3:63]                                                                                    |
```

```
Rung #499
|MANUAL
|CONTROL
|CRYO GATE                                                        MANUAL CRYO
|12 OPEN                                                          GATE 12 OPEN
|M-HV12-1                                                         MCG12OP
|  N7:5                                                              N7:26
|----| |------------------------------------------------------------+--(L)--+--|
|     0                                                              |   0    |
|[3]                                                                 |        |
| N7:26/0 - -| |- - File #2 MAIN_PRGRM - 137, 138, 502               |        |
|           -(U)- - File #2 MAIN_PRGRM - 500                         |MANUAL CRYO
| _F:N7:21L%21 - BTW - File #2 MAIN_PRGRM - 2                        |GATE 12 CLOSE
| N7:27/7 - -(L)- - File #2 MAIN_PRGRM - 500                         |MCG12CL
| _F:N7:21L%21 - BTW - File #2 MAIN_PRGRM - 2                        |   N7:27
|                                                                    +--(U)---+
|                                                                        7
Rung #500
| MANUAL
| CONTROL
| CRYO GATE                                                       MANUAL CRYO
| 12 CLOSE                                                        GATE 12 OPEN
| M-HV12-O                                                        MCG12OP
|    N7:6                                                            N7:26
|-+-----| |--+------------------------------------------------------+--(U)--+--|
| |      7   |                                                       |   0    |
| |[3]       |                                                       |        |
|            | N7:26/0 - -| |- - File #2 MAIN_PRGRM - 137, 138, 502 |        |
| |          |           -(L)- - File #2 MAIN_PRGRM - 499            |        |
| |MANUAL    | _F:N7:21L%21 - BTW - File #2 MAIN_PRGRM - 2            |MANUAL CRYO
| |CONTROL   | N7:27/7 - -(U)- - File #2 MAIN_PRGRM - 499             |GATE 12 CLOSE
| |CRYO GATE | _F:N7:21L%21 - BTW - File #2 MAIN_PRGRM - 2            |MCG12CL
| |12THROTTLE|                                                       |   N7:27
| |M-HV12-2  |                                                       +--(L)---+
| |   N7:5   |                                                           7
| |----| |---|
| |     11   |
| |[3]       |
| |PREPARE FOR
| |AUTO RUN  |
| |>AUTO     |
| |   N7:37  |
| |----| |---|
| |      1   |
| |[162]     |
| |COMPRESSOR|
| |7 REGEN-  |
| |ERATION   |
| |PROGRAM   |
|  :YRGN7    |
| |    B3    |
| +----| |---+
|     327
|  [3:57]
```

```
Rung #501
|MANUAL                                                                                        |
|CONTROL                                                                    MANUAL CRYO        |
|CRYO GATE                                                                  GATE 12            |
|12THROTTLE                                                                 THROTTLE           |
|M-HV12-2                                                                   MCG12TL            |
|    N7:5                                                                       N7:26          |
|----] [--------------------------------------------------------------------------(L)---------|
|     11                                                                          11           |
|[3]                                                                                           |
N7:26/11 - ] [ - File #2 MAIN_PRGRM -  138,138
          -(L)- - File #2 MAIN_PRGRM -  501
          -(U)- - File #2 MAIN_PRGRM -  502
_F:N7:21[X21 - BTW - File #2 MAIN_PRGRM -  2
Rung #502
| MANUAL                                                                                       |
| CONTROL                                                                   MANUAL CRYO        |
| CRYO GATE                                                                 GATE 12            |
| 12 CLOSE                                                                  THROTTLE           |
| M-HV12-0                                                                  MCG12TL            |
|    N7:6                                                                       N7:26          |
|-+----] [-------+--------------------------------------------------------------(U)-----------|
| |     7        |                                                                11           |
| |[3]           |                                                                             |
| |              | N7:26/11 - ] [ - File #2 MAIN_PRGRM - 138                                    |
| |              |           -(L)- - File #2 MAIN_PRGRM - 501                                   |
| |              | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                                  |
| |MANUAL CRYO   |                                                                             |
| |GATE 12 OPEN  |                                                                             |
| |MCG12OP       |                                                                             |
| |    N7:26     |                                                                             |
| |----] [-------|                                                                             |
| |     0        |                                                                             |
| |[500]         |                                                                             |
| |PREPARE FOR   |                                                                             |
| |AUTO RUN      |                                                                             |
| |>AUTO         |                                                                             |
| |    N7:37     |                                                                             |
| |----] [-------|                                                                             |
| |     1        |                                                                             |
| |[162]         |                                                                             |
| |COMPRESSOR    |                                                                             |
| |7 REGEN-      |                                                                             |
| |ERATION       |                                                                             |
| |PROGRAM       |                                                                             |
| |CYRGN7        |                                                                             |
| |    B3        |                                                                             |
| +----] [-------+                                                                             |
|      327                                                                                     |
  [3:57]                                                                                       |
```

```
Rung #503
|MANUAL CONTROL                                                    MANUAL ROUGH
|ROUGH PUMP                                                        PUMP VALVE
|VALVE 1 OPEN                                                      1 OPEN
|M-RV1-1                                                           MRPV1OP
|      N7:7                                                           N7:28
|------] [-----------------------------------------------------------(L)----|
        0                                                               0
|[3]
| N7:28/0 - -] [- - File #2 MAIN_PRGRM - 167                       |MANUAL ROUGH
|           -(U)- - File #2 MAIN_PRGRM - 508                       |PUMP VALVE
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                      |1 CLOSE
| N7:33/3 - -(L)- - File #2 MAIN_PRGRM - 508                       |MRPV1CL
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                      |  N7:33
|                                                                  |---(U)---
|                                                                       3

Rung #504
|MANUAL CONTROL                                                    MANUAL ROUGH
|ROUGH PUMP                                                        PUMP VALVE
|VALVE 2 OPEN                                                      2 OPEN
|M-RV2-1                                                           MRPV2OP
|      N7:7                                                           N7:28
|------] [-----------------------------------------------------------(L)----|
        1                                                               1
|[3]
| N7:28/1 - -] [- - File #2 MAIN_PRGRM - 56                        |MANUAL ROUGH
|           -(U)- - File #2 MAIN_PRGRM - 509                       |PUMP VALVE
  F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                       |2 CLOSE
  N7:33/4 - -(L)- - File #2 MAIN_PRGRM - 509                       |MRPV2CL
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                      |  N7:33
|                                                                  |---(U)---
|                                                                       4

Rung #505
|MANUAL CONTROL                                                    MANUAL ROUGH
|ROUGH PUMP                                                        PUMP VALVE
|VALVE 3 OPEN                                                      3 OPEN
|M-RV3-1                                                           MRPV3OP
|      N7:7                                                           N7:28
|------] [-----------------------------------------------------------(L)----|
        2                                                               2
|[3]
| N7:28/2 - -] [- - File #2 MAIN_PRGRM - 57                        |MANUAL ROUGH
|           -(U)- - File #2 MAIN_PRGRM - 510                       |PUMP VALVE
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                      |3 CLOSE
| N7:33/5 - -(L)- - File #2 MAIN_PRGRM - 510                       |MRPV3CL
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                      |  N7:33
|                                                                  |---(U)---
|                                                                       5

Rung #506
  NUAL CONTROL                                                     MANUAL ROUGH
 ..UGH PUMP                                                        PUMP VALVE
|VALVE 4 OPEN                                                      4 OPEN
|M-RV4-1                                                           MRPV4OP
|      N7:7                                                           N7:28
|------] [-----------------------------------------------------------(L)----|
        3                                                               3
|[3]
| N7:28/3 - -] [- - File #2 MAIN_PRGRM - 58                        |MANUAL ROUGH
|           -(U)- - File #2 MAIN_PRGRM - 511                       |PUMP VALVE
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                      |4 CLOSE
| N7:33/6 - -(L)- - File #2 MAIN_PRGRM - 511                       |MRPV4CL
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                      |  N7:33
|                                                                  |---(U)---
>                                                                           >
```

```
Rung #507
MANUAL CONTROL                                              MANUAL ROUGH
ROUGH PUMP                                                  PUMP VALVE
VALVE 5 OPEN                                                5 OPEN
M-RV5-1                                                     MRVP5OP
   N7:7                                                       N7:28
---] [-------------------------------------------------------+--(L)--+
   4                                                         |   4   |
[3]                                                          |       |
N7:28/4 - ] [ - File #2 MAIN_PRGRM - 340                     |MANUAL ROUGH
        -(U)- - File #2 MAIN_PRGRM - 512                     |PUMP VALVE
_F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                  |5 CLOSE
N7:33/7 - -(L)- - File #2 MAIN_PRGRM - 512                   |MRPV5CL
_F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                  |   N7:33
                                                             +--(U)--+
                                                                 7

Rung #508
MANUAL
CONTROL
ROUGH PUMP                                                  MANUAL ROUGH
1 VALVE                                                     PUMP VALVE
CLOSE                                                       1 OPEN
M-RV1-0                                                     MRPV1OP
   N7:12                                                      N7:28
-+-] [-+-----------------------------------------------------+--(U)--+
 |  3  |                                                     |   0   |
 |[3]  | N7:28/0 - ] [ - File #2 MAIN_PRGRM - 167            |       |
 |     |           -(L)- - File #2 MAIN_PRGRM - 503          |MANUAL ROUGH
 |     | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2         |PUMP VALVE
 |     | N7:33/3 - -(U)- - File #2 MAIN_PRGRM - 503          |1 CLOSE
 |PREPARE FOR | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2  |MRPV1CL
 |AUTO RUN    |                                              |   N7:33
 |>AUTO       |                                              +--(L)--+
 |   N7:37    |                                                  3
 +---] [------+
      1
[162]

Rung #509
MANUAL
CONTROL
ROUGH PUMP                                                  MANUAL ROUGH
2 VALVE                                                     PUMP VALVE
CLOSE                                                       2 OPEN
M-RV2-0                                                     MRPV2OP
   N7:12                                                      N7:28
-+-] [-+-----------------------------------------------------+--(U)--+
 |  4  |                                                     |   1   |
 |[3]  | N7:28/1 - ] [ - File #2 MAIN_PRGRM - 56             |       |
 |     |           -(L)- - File #2 MAIN_PRGRM - 504          |MANUAL ROUGH
 |     | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2         |PUMP VALVE
 |     | N7:33/4 - -(U)- - File #2 MAIN_PRGRM - 504          |2 CLOSE
 |PREPARE FOR | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2  |MRPV2CL
 |AUTO RUN    |                                              |   N7:33
 |>AUTO       |                                              +--(L)--+
 |   N7:37    |                                                  4
 +---] [------+
      1
[162]
```

426

```
Rung #510
| MANUAL
| CONTROL
| ROUGH PUMP                                                                              MANUAL ROUGH |
| 3  VALVE                                                                                PUMP VALVE   |
| CLOSE                                                                                   3 OPEN       |
| M-RV3-0                                                                                 MRPV3OP      |
|    N7:12                                                                                   N7:28     |
|-+---] [---+------------------------------------------------------------------------+------(U)-----+-|
| |    5    |                                                                        |       2      | |
| |[3]      |                                                                        |              | |
| |         | N7:28/2 - ] [ - File #2 MAIN_PRGRM - 57                                |              | |
| |         |         -(L)- - File #2 MAIN_PRGRM - 505                               |MANUAL ROUGH  | |
| |         | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                            |PUMP VALVE    | |
| |         | N7:33/5 - -(U)- - File #2 MAIN_PRGRM - 505                             |3 CLOSE       | |
| |PREPARE FOR | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                         |MRPV3CL       | |
| |AUTO RUN |                                                                        |   N7:33      | |
| |>AUTO    |                                                                        +-----(L)------+ |
| |   N7:37 |                                                                             5           |
| +---] [---+                                                                                         |
|      1                                                                                              |
| [162]                                                                                               |
Rung #511
| MANUAL
| CONTROL
| ROUGH PUMP                                                                              MANUAL ROUGH |
| 4  VALVE                                                                                PUMP VALVE   |
| CLOSE                                                                                   4 OPEN       |
  4-RV4-0                                                                                 MRPV4OP      |
|    N7:12                                                                                   N7:28     |
|-+---] [---+------------------------------------------------------------------------+------(U)-----+-|
| |    6    |                                                                        |       3      | |
| |[3]      |                                                                        |              | |
| |         | N7:28/3 - ] [ - File #2 MAIN_PRGRM - 58                                |              | |
| |         |         -(L)- - File #2 MAIN_PRGRM - 506                               |MANUAL ROUGH  | |
| |         | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                            |PUMP VALVE    | |
| |         | N7:33/6 - -(U)- - File #2 MAIN_PRGRM - 506                             |4 CLOSE       | |
| |PREPARE FOR | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                         |MRPV4CL       | |
| |AUTO RUN |                                                                        |   N7:33      | |
| |>AUTO    |                                                                        +-----(L)------+ |
| |   N7:37 |                                                                             6           |
| +---] [---+                                                                                         |
|      1                                                                                              |
| [162]                                                                                               |
```

```
Rung #512
| MANUAL
| CONTROL
| ROUGH PUMP                                                                     MANUAL ROUGH
| 5 VALVE                                                                        PUMP VALVE
| CLOSE                                                                          5 OPEN
| M-RV5-0                                                                        MRVP5OP
|   N7:12                                                                          N7:28
|-+---] [---+--------------------------------------------------------------+------(U)----+-
| |   7     |                                                              |       4     |
| |[3]      |                                                              |             |
| |         | N7:28/4 - -] [- - File #2 MAIN_PRGRM - 340                   |             |
| |         |           -(L)- - File #2 MAIN_PRGRM - 507                   |MANUAL ROUGH |
| |         | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                  |PUMP VALVE   |
| |         | N7:33/7 - -(U)- - File #2 MAIN_PRGRM - 507                   |5 CLOSE      |
| |PREPARE FOR | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2               |MRPV5CL      |
| |AUTO RUN |                                                              |   N7:33     |
| |>AUTO    |                                                              +----(L)------+
| |  N7:37  |                                                                    7
| +---] [---+
|      1
| [162]
Rung #513
|MANUAL
|CONTROL
|MOTOR 3                                                                         MANUAL MOTOR
|ON                                                                              3 ON
 -MCON3                                                                          MM3ON
  N7:2                                                                             N7:23
|---] [----------------------------------------------------------------------------(L)----|
|   1                                                                                1
|[3]
N7:23/1 - -] [- - File #2 MAIN_PRGRM -  185,187
          -]/[- - File #2 MAIN_PRGRM -  532
          -(L)- - File #2 MAIN_PRGRM -  513
          -(U)- - File #2 MAIN_PRGRM -  551
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM -  2
Rung #514
|MANUAL
|CONTROL
|MOTOR 4                                                                         MANUAL MOTOR
|ON                                                                              4 ON
|M-MCON4                                                                         MM4ON
| N7:2                                                                             N7:23
|---] [----------------------------------------------------------------------------(L)----|
|   2                                                                                2
|[3]
N7:23/2 - -] [- - File #2 MAIN_PRGRM -  190,192
          -]/[- - File #2 MAIN_PRGRM -  533
          -(L)- - File #2 MAIN_PRGRM -  514
          -(U)- - File #2 MAIN_PRGRM -  552
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM -  2
Rung #515
|MANUAL
|CONTROL
|MOTOR 5                                                                         MANUAL MOTOR
|ON                                                                              5 ON
|M-MCON5                                                                         MM5ON
| N7:2                                                                             N7:23
|---] [----------------------------------------------------------------------------(L)----|
|   3                                                                                3
|[3]
```

```
N7:23/3 - -| |- - File #2 MAIN_PRGRM -  195,197
          -|/|- - File #2 MAIN_PRGRM -  534
          -(L)- - File #2 MAIN_PRGRM -  515
          -(U)- - File #2 MAIN_PRGRM -  553
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM -  2
```

Rung #516

```
|MANUAL                                                              |
|CONTROL                                                             |
|MOTOR 6                                             MANUAL MOTOR    |
|ON                                                  6 ON            |
|M-MCON6                                             MM6ON           |
|  N7:2                                                 N7:23        |
|---| |-------------------------------------------------(L)----------|
|     4                                                  4           |
|[3]
N7:23/4 - -| |- - File #2 MAIN_PRGRM -  218,220
          -|/|- - File #2 MAIN_PRGRM -  535
          -(L)- - File #2 MAIN_PRGRM -  516
          -(U)- - File #2 MAIN_PRGRM -  554
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM -  2
```

Rung #517

```
|MANUAL                                                              |
|CONTROL                                                             |
|MOTOR 7                                             MANUAL MOTOR    |
|ON                                                  7 ON            |
|M-MCON7                                             MM7ON           |
|  N7:2                                                 N7:23        |
|---| |-------------------------------------------------(L)----------|
|     5                                                  5           |
|[3]
N7:23/5 - -| |- - File #2 MAIN_PRGRM -  231,233
          -|/|- - File #2 MAIN_PRGRM -  536
          -(L)- - File #2 MAIN_PRGRM -  517
          -(U)- - File #2 MAIN_PRGRM -  555
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM -  2
```

Rung #518

```
|MANUAL                                                              |
|CONTROL                                                             |
|MOTOR 8                                             MANUAL MOTOR    |
|ON                                                  8 ON            |
|M-MCON8                                             MM8ON           |
|  N7:2                                                 N7:23        |
|---| |-------------------------------------------------(L)----------|
|     6                                                  6           |
|[3]
N7:23/6 - -| |- - File #2 MAIN_PRGRM -  249
          -|/|- - File #2 MAIN_PRGRM -  537
          -(L)- - File #2 MAIN_PRGRM -  518
          -(U)- - File #2 MAIN_PRGRM -  556
F:N7:21[%21 - BTW - File #2 MAIN_PRGRM -  2
```

Rung #519

```
|MANUAL                                                              |
|CONTROL                                                             |
|MOTOR 9                                             MANUAL MOTOR    |
|ON                                                  9 ON            |
|M-MCON9                                             MM9ON           |
|  N7:2                                                 N7:23        |
|---| |-------------------------------------------------(L)----------|
|     7                                                  7           |
|[3]
N7:23/7 - -| |- - File #2 MAIN_PRGRM -  253,255
          -|/|- - File #2 MAIN_PRGRM -  538
```

```
        -(L)- - File #2 MAIN_PRGRM -  519
        -(U)- - File #2 MAIN_PRGRM -  557
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM -  2
```

Rung #520

```
|MANUAL                                                         |
|CONTROL                                                        |
|MOTOR 10                                       MANUAL MOTOR    |
|ON                                             10 ON           |
|M-MCON10                                       MM10ON          |
|  N7:2                                            N7:23        |
|--] [-------------------------------------------------(L)------|
|   8                                                 8         |
|[3]                                                            |
N7:23/8 - ] [ - - File #2 MAIN_PRGRM -  258,260
        ]/[ - - File #2 MAIN_PRGRM -  539
        -(L)- - File #2 MAIN_PRGRM -  520
        -(U)- - File #2 MAIN_PRGRM -  558
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM -  2
```

Rung #521

```
|MANUAL                                                         |
|CONTROL                                                        |
|MOTOR 11                                       MANUAL MOTOR    |
|ON                                             11 ON           |
|M-MCON11                                       MM11ON          |
|  N7:2                                            N7:23        |
|--] [-------------------------------------------------(L)------|
|   9                                                 9         |
 3]                                                             |
.:23/9 - ] [ - - File #2 MAIN_PRGRM -  263,265
        ]/[ - - File #2 MAIN_PRGRM -  540
        -(L)- - File #2 MAIN_PRGRM -  521
        -(U)- - File #2 MAIN_PRGRM -  559
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM -  2
```

Rung #522

```
|MANUAL                                                         |
|CONTROL                                                        |
|MOTOR 12                                       MANUAL MOTOR    |
|ON                                             12 ON           |
|M-MCON12                                       MM12ON          |
|  N7:2                                            N7:23        |
|--] [-------------------------------------------------(L)------|
|   10                                                10        |
|[3]                                                            |
N7:23/10 - ] [ - - File #2 MAIN_PRGRM -  281
        ]/[ - - File #2 MAIN_PRGRM -  541
        -(L)- - File #2 MAIN_PRGRM -  522
        -(U)- - File #2 MAIN_PRGRM -  560
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM -  2
```

Rung #523

```
 NUAL                                                           |
 .NTROL                                                         |
|MOTOR 13                                       MANUAL MOTOR    |
|ON                                             13 ON           |
|M-MCON13                                       MM13ON          |
|  N7:2                                            N7:23        |
|--] [-------------------------------------------------(L)------|
|   11                                                11        |
|[3]                                                            |
N7:23/11 - ] [ - - File #2 MAIN_PRGRM -  285,287
        ]/[ - - File #2 MAIN_PRGRM -  542
        -(L)- - File #2 MAIN_PRGRM -  523
        -(U)- - File #2 MAIN_PRGRM -  561
```

```
_F:N7:211X21 - BTW - File #2 MAIN_PRGRM -  2
Rung #524
|MANUAL                                                                        |
|CONTROL                                                                       |
|MOTOR 14                                                 MANUAL MOTOR         |
|ON                                                       14 ON                |
|M-MCON14                                                 MM14ON               |
|   N7:2                                                    N7:23              |
|--| |-----------------------------------------------------------(L)-----------|
|   12                                                        12               |
|[3]                                                                           |
N7:23/12 - -| |- - File #2 MAIN_PRGRM -  290,292
           -|/|- - File #2 MAIN_PRGRM -  543
           -(L)- - File #2 MAIN_PRGRM -  524
           -(U)- - File #2 MAIN_PRGRM -  562
_F:N7:211X21 - BTW - File #2 MAIN_PRGRM -  2
Rung #525
|MANUAL                                                                        |
|CONTROL                                                                       |
|MOTOR 15                                                 MANUAL MOTOR         |
|ON                                                       15 ON                |
|M-MCON15                                                 MM15ON               |
|   N7:2                                                    N7:23              |
|--| |-----------------------------------------------------------(L)-----------|
|   13                                                        13               |
|[3]                                                                           |
N7:23/13 - -| |- - File #2 MAIN_PRGRM -  295,297
           -|/|- - File #2 MAIN_PRGRM -  544
           -(L)- - File #2 MAIN_PRGRM -  525
           -(U)- - File #2 MAIN_PRGRM -  563
_F:N7:211X21 - BTW - File #2 MAIN_PRGRM -  2
Rung #526
|MANUAL                                                                        |
|CONTROL                                                                       |
|MOTOR 16                                                 MANUAL MOTOR         |
|ON                                                       16 ON                |
|M-MCON16                                                 MM16ON               |
|   N7:2                                                    N7:23              |
|--| |-----------------------------------------------------------(L)-----------|
|   14                                                        14               |
|[3]                                                                           |
N7:23/14 - -| |- - File #2 MAIN_PRGRM -  306
           -|/|- - File #2 MAIN_PRGRM -  545
           -(L)- - File #2 MAIN_PRGRM -  526
           -(U)- - File #2 MAIN_PRGRM -  564
_F:N7:211X21 - BTW - File #2 MAIN_PRGRM -  2
Rung #527
|MANUAL                                                                        |
|CONTROL                                                                       |
 OTOR 17                                                  MANUAL MOTOR         |
                                                          17 ON                |
|M-MCON17                                                 MM17ON               |
|   N7:2                                                    N7:23              |
|--| |-----------------------------------------------------------(L)-----------|
|   15                                                        15               |
|[3]                                                                           |
N7:23/15 - -| |- - File #2 MAIN_PRGRM -  310,312
           -|/|- - File #2 MAIN_PRGRM -  546
           -(L)- - File #2 MAIN_PRGRM -  527
           -(U)- - File #2 MAIN_PRGRM -  565
_F:N7:211X21 - BTW - File #2 MAIN_PRGRM -  2
```

431

```
Rung #528
|MANUAL
|CONTROL
|MOTOR 18                                                              MANUAL MOTOR
|ON                                                                    18 ON
|M-MCON18                                                              MM18ON
|  N7:3                                                                    N7:24
|--] [------------------------------------------------------------------(L)---|
|    0                                                                      0
|[3]
N7:24/0 - ] [ - File #2 MAIN_PRGRM -  315,317
          ]/[ - File #2 MAIN_PRGRM -  547
          -(L)- - File #2 MAIN_PRGRM -  528
          -(U)- - File #2 MAIN_PRGRM -  566
_F:N7:21L21 - BTW - File #2 MAIN_PRGRM -  2
Rung #529
|MANUAL
|CONTROL
|MOTOR 19                                                              MANUAL MOTOR
|ON                                                                    19 ON
|M-MCON19                                                              MM19ON
|  N7:3                                                                    N7:24
|--] [------------------------------------------------------------------(L)---|
|    1                                                                      1
|[3]
N7:24/1 - ] [ - File #2 MAIN_PRGRM -  320,322
          ]/[ - File #2 MAIN_PRGRM -  548
          -(L)- - File #2 MAIN_PRGRM -  529
          -(U)- - File #2 MAIN_PRGRM -  567
_F:N7:21L21 - BTW - File #2 MAIN_PRGRM -  2
Rung #530
|MANUAL
|CONTROL
|MOTOR 20                                                              MANUAL MOTOR
|ON                                                                    20 ON
|M-MCON20                                                              MM20ON
|  N7:3                                                                    N7:24
|--] [------------------------------------------------------------------(L)---|
|    2                                                                      2
|[3]
N7:24/2 - ] [ - File #2 MAIN_PRGRM -  331,333
          ]/[ - File #2 MAIN_PRGRM -  549,550
          -(L)- - File #2 MAIN_PRGRM -  530
          -(U)- - File #2 MAIN_PRGRM -  568
_F:N7:21L21 - BTW - File #2 MAIN_PRGRM -  2
Rung #531
|MANUAL
|CONTROL
|MOTOR 21                                                              MANUAL MOTOR
  N                                                                    21 ON
  MCON21                                                               MM21ON
|  N7:3                                                                    N7:24
|--] [------------------------------------------------------------------(L)---|
|    3                                                                      3
|[3]
N7:24/3 - ] [ - File #2 MAIN_PRGRM -  355,357
          -(L)- - File #2 MAIN_PRGRM -  531
          -(U)- - File #2 MAIN_PRGRM -  569
_F:N7:21L21 - BTW - File #2 MAIN_PRGRM -  2
```

```
Rung #532
|MANUAL MOTOR                                                     MANUAL MOTOR |
|3 ON                                                             3 OFF        |
|MM3ON                                                            MM3OFF       |
|    N7:23                                                           N7:21     |
|----|/|-------------------------------------------------------------( )-------|
|     1                                                               3        |
|[513]                                                                         |
N7:21 - BTW - File #2 MAIN_PRGRM -  2
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM -  2
Rung #533
|MANUAL MOTOR                                                     MANUAL MOTOR |
|4 ON                                                             4 OFF        |
|MM4ON                                                            MM4OFF       |
|    N7:23                                                           N7:21     |
|----|/|-------------------------------------------------------------( )-------|
|     2                                                               4        |
|[514]                                                                         |
N7:21 - BTW - File #2 MAIN_PRGRM -  2
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM -  2
Rung #534
|MANUAL MOTOR                                                     MANUAL MOTOR |
|5 ON                                                             5 OFF        |
|MM5ON                                                            MM5OFF       |
|    N7:23                                                           N7:21     |
|----|/|-------------------------------------------------------------( )-------|
|     3                                                               5        |
 515]                                                                          |
  :21 - BTW - File #2 MAIN_PRGRM -  2
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM -  2
Rung #535
|MANUAL MOTOR                                                     MANUAL MOTOR |
|6 ON                                                             6 OFF        |
|MM6ON                                                            MM6OFF       |
|    N7:23                                                           N7:21     |
|----|/|-------------------------------------------------------------( )-------|
|     4                                                               6        |
|[516]                                                                         |
N7:21 - BTW - File #2 MAIN_PRGRM -  2
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM -  2
Rung #536
|MANUAL MOTOR                                                     MANUAL MOTOR |
|7 ON                                                             7 OFF        |
|MM7ON                                                            MM7OFF       |
|    N7:23                                                           N7:21     |
|----|/|-------------------------------------------------------------( )-------|
|     5                                                               7        |
|[517]                                                                         |
N7:21 - BTW - File #2 MAIN_PRGRM -  2
 :N7:21[%21 - BTW - File #2 MAIN_PRGRM -  2
 ung #537
|MANUAL MOTOR                                                     MANUAL MOTOR |
|8 ON                                                             8 OFF        |
|MM8ON                                                            MM8OFF       |
|    N7:23                                                           N7:21     |
|----|/|-------------------------------------------------------------( )-------|
|     6                                                               8        |
|[518]                                                                         |
N7:21 - BTW - File #2 MAIN_PRGRM -  2
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM -  2
```

Rung #538
```
|MANUAL MOTOR                                    MANUAL MOTOR |
|9 ON                                            9 OFF        |
|MM9ON                                           MM9OFF       |
|    N7:23                                          N7:21     |
|----|/|--------------------------------------------( )-------|
|     7                                               9       |
|[519]                                                        |
N7:21 - BTW - File #2 MAIN_PRGRM -  2
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM -  2
```
Rung #539
```
|MANUAL MOTOR                                    MANUAL MOTOR |
|10 ON                                           10 OFF       |
|MM10ON                                          MM10OFF      |
|    N7:23                                          N7:21     |
|----|/|--------------------------------------------( )-------|
|     8                                               10      |
|[520]                                                        |
N7:21 - BTW - File #2 MAIN_PRGRM -  2
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM -  2
```
Rung #540
```
|MANUAL MOTOR                                    MANUAL MOTOR |
|11 ON                                           11 OFF       |
|MM11ON                                          MM11OFF      |
|    N7:23                                          N7:21     |
|----|/|--------------------------------------------( )-------|
|     9                                               11      |
 521]                                                         |
..:21 - BTW - File #2 MAIN_PRGRM -  2
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM -  2
```
Rung #541
```
|MANUAL MOTOR                                    MANUAL MOTOR |
|12 ON                                           12 OFF       |
|MM12ON                                          MM12OFF      |
|    N7:23                                          N7:21     |
|----|/|--------------------------------------------( )-------|
|     10                                              12      |
|[522]                                                        |
N7:21 - BTW - File #2 MAIN_PRGRM -  2
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM -  2
```
Rung #542
```
|MANUAL MOTOR                                    MANUAL MOTOR |
|13 ON                                           13 OFF       |
|MM13ON                                          MM13OFF      |
|    N7:23                                          N7:21     |
|----|/|--------------------------------------------( )-------|
|     11                                              13      |
|[523]                                                        |
N7:21 - BTW - File #2 MAIN_PRGRM -  2
_:N7:21[%21 - BTW - File #2 MAIN_PRGRM -  2
```
.ung #543
```
|MANUAL MOTOR                                    MANUAL MOTOR |
|14 ON                                           14 OFF       |
|MM14ON                                          MM14OFF      |
|    N7:23                                          N7:21     |
|----|/|--------------------------------------------( )-------|
|     12                                              14      |
|[524]                                                        |
N7:21 - BTW - File #2 MAIN_PRGRM -  2
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM -  2
```

```
Rung #544
|MANUAL MOTOR                                                    MANUAL MOTOR |
|15 ON                                                           15 OFF       |
|MM15ON                                                          MM15OFF      |
|    N7:23                                                          N7:21     |
|----|/|----------------------------------------------------------------( )----|
|     13                                                              15      |
|[525]                                                                        |
N7:21 - BTW - File #2 MAIN_PRGRM -  2
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM -  2
Rung #545
|MANUAL MOTOR                                                    MANUAL MOTOR |
|16 ON                                                           16 OFF       |
|MM16ON                                                          MM16OFF      |
|    N7:23                                                          N7:22     |
|----|/|----------------------------------------------------------------( )----|
|     14                                                              0       |
|[526]                                                                        |
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM -  2
Rung #546
|MANUAL MOTOR                                                    MANUAL MOTOR |
|17 ON                                                           17 OFF       |
|MM17ON                                                          MM17OFF      |
|    N7:23                                                          N7:22     |
|----|/|----------------------------------------------------------------( )----|
|     15                                                              1       |
|[527]                                                                        |
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM -  2
Rung #547
|MANUAL MOTOR                                                    MANUAL MOTOR |
|18 ON                                                           18 OFF       |
|MM18ON                                                          MM18OFF      |
|    N7:24                                                          N7:22     |
|----|/|----------------------------------------------------------------( )----|
|     0                                                               2       |
|[528]                                                                        |
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM -  2
Rung #548
|MANUAL MOTOR                                                    MANUAL MOTOR |
|19 ON                                                           19 OFF       |
|MM19ON                                                          MM19OFF      |
|    N7:24                                                          N7:22     |
|----|/|----------------------------------------------------------------( )----|
|     1                                                               3       |
|[529]                                                                        |
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM -  2
Rung #549
|MANUAL MOTOR                                                    MANUAL MOTOR |
|20 ON                                                           20 OFF       |
|MM20ON                                                          MM20OFF      |
|    N7:24                                                          N7:22     |
|----|/|----------------------------------------------------------------( )----|
|     2                                                               4       |
|[530]                                                                        |
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM -  2
Rung #550
|MANUAL MOTOR                                                    MANUAL MOTOR |
|20 ON                                                           21 OFF       |
|MM20ON                                                          MM21OFF      |
|    N7:24                                                          N7:22     |
|----|/|----------------------------------------------------------------( )----|
|     2                                                               5       |
|[568]                                                                        |
```

```
_F:N7:21L%21 - BTW - File #2 MAIN_PRGRM -  2
Rung #551
| MANUAL
| CONTROL
| MOTOR 3                                                         MANUAL MOTOR
| OFF                                                             3 ON
| M-MCOF3                                                         MM3ON
|  N7:0                                                              N7:23
|-+---] [---+-----------------------------------------------------------(U)---|
| |    3    |                                                            1
| |[3]      |
| |         | N7:23/1 - ] [ - File #2 MAIN_PRGRM - 185, 187
| |         |           ]/[ - File #2 MAIN_PRGRM - 532
| |         |           (L) - File #2 MAIN_PRGRM - 513
| |         | _F:N7:21L%21 - BTW - File #2 MAIN_PRGRM - 2
| |PREPARE FOR |
| |AUTO RUN |
| |>AUTO    |
| |   N7:37 |
| +---] [---+
|      1
| [162]
Rung #552
| MANUAL
| CONTROL
| MOTOR 4                                                         MANUAL MOTOR
| OFF                                                             4 ON
| M-MCOF4                                                         MM4ON
|  N7:0                                                              N7:23
|-+---] [---+-----------------------------------------------------------(U)---|
| |    4    |                                                            2
| |[3]      |
| |         | N7:23/2 - ] [ - File #2 MAIN_PRGRM - 190, 192
| |         |           ]/[ - File #2 MAIN_PRGRM - 533
| |         |           (L) - File #2 MAIN_PRGRM - 514
| |         | _F:N7:21L%21 - BTW - File #2 MAIN_PRGRM - 2
| |PREPARE FOR |
| |AUTO RUN |
| |>AUTO    |
| |   N7:37 |
| +---] [---+
|      1
| [162]
```

```
Rung #553
| MANUAL                                                              |
| CONTROL                                                             |
| MOTOR 5                                           MANUAL MOTOR      |
| OFF                                               5 ON              |
| M-MCOF5                                           MM5ON             |
|   N7:0                                                N7:23         |
|-+--| |--+---------------------------------------------(U)----------|
| |    5  |                                               3           |
| |[3]    |                                                           |
| |       | N7:23/3 - -| |- - File #2 MAIN_PRGRM - 195, 197          |
| |       |           -|/|- - File #2 MAIN_PRGRM - 534                |
| |       |           -(L)- - File #2 MAIN_PRGRM - 515                |
| |       | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2               |
| |PREPARE FOR |                                                      |
| |AUTO RUN    |                                                      |
| |>AUTO       |                                                      |
| |   N7:37    |                                                      |
| +----| |-----+                                                      |
|        1                                                            |
|  [162]                                                              |
Rung #554
| MANUAL                                                              |
| CONTROL                                                             |
| MOTOR 6                                           MANUAL MOTOR      |
| OFF                                               6 ON              |
| M-MCOF6                                           MM6ON             |
|   N7:0                                                N7:23         |
|-+--| |--+---------------------------------------------(U)----------|
| |    6  |                                               4           |
| |[3]    |                                                           |
| |       | N7:23/4 - -| |- - File #2 MAIN_PRGRM - 218, 220          |
| |       |           -|/|- - File #2 MAIN_PRGRM - 535                |
| |       |           -(L)- - File #2 MAIN_PRGRM - 516                |
| |       | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2               |
| |PREPARE FOR |                                                      |
| |AUTO RUN    |                                                      |
| |>AUTO       |                                                      |
| |   N7:37    |                                                      |
| +----| |-----+                                                      |
|        1                                                            |
|  [162]                                                              |
Rung #555
| MANUAL                                                              |
| CONTROL                                                             |
| MOTOR 7                                           MANUAL MOTOR      |
| OFF                                               7 ON              |
| M-MCOF7                                           MM7ON             |
|   N7:0                                                N7:23         |
|-+--| |--+---------------------------------------------(U)----------|
| |    7  |                                               5           |
| |[3]    |                                                           |
| |       | N7:23/5 - -| |- - File #2 MAIN_PRGRM - 231, 233          |
| |       |           -|/|- - File #2 MAIN_PRGRM - 536                |
| |       |           -(L)- - File #2 MAIN_PRGRM - 517                |
| |       | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2               |
| |PREPARE FOR |                                                      |
| |AUTO RUN    |                                                      |
| |>AUTO       |                                                      |
| |   N7:37    |                                                      |
| +----| |-----+                                                      |
|        1                                                            |
|  [162]                                                              |
```

```
Rung #556
| MANUAL                                                                    |
| CONTROL                                                                   |
| MOTOR 8                                                    MANUAL MOTOR   |
| OFF                                                        8 ON           |
| M-MCOF8                                                    MM8ON          |
|   N7:0                                                       N7:23        |
|--+--| |--+---------------------------------------------------(U)----------|
|  |   8   |                                                     6          |
|  |[3]    |                                                                |
|  |       | N7:23/6 - -| |- - File #2 MAIN_PRGRM - 249                     |
|  |       |           -|/|- - File #2 MAIN_PRGRM - 537                     |
|  |       |           -(L)- - File #2 MAIN_PRGRM - 518                     |
|  |       | _F:N7:21LX21 - BTW - File #2 MAIN_PRGRM - 2                    |
|  |PREPARE FOR                                                             |
|  |AUTO RUN                                                                |
|  |>AUTO  |                                                                |
|  |  N7:37|                                                                |
|  +--| |--+                                                                |
|      1                                                                   |
| [162]                                                                     |
Rung #557
| MANUAL                                                                    |
| CONTROL                                                                   |
| MOTOR 9                                                    MANUAL MOTOR   |
| OFF                                                        9 ON           |
| M-MCOF9                                                    MM9ON          |
|   N7:0                                                       N7:23        |
|--+--| |--+---------------------------------------------------(U)----------|
|  |   9   |                                                     7          |
|  |[3]    |                                                                |
|  |       | N7:23/7 - -| |- - File #2 MAIN_PRGRM - 253, 255                |
|  |       |           -|/|- - File #2 MAIN_PRGRM - 538                     |
|  |       |           -(L)- - File #2 MAIN_PRGRM - 519                     |
|  |       | _F:N7:21LX21 - BTW - File #2 MAIN_PRGRM - 2                    |
|  |PREPARE FOR                                                             |
|  |AUTO RUN                                                                |
|  |>AUTO  |                                                                |
|  |  N7:37|                                                                |
|  +--| |--+                                                                |
|      1                                                                   |
| [162]                                                                     |
Rung #558
| MANUAL                                                                    |
| CONTROL                                                                   |
| MOTOR 10                                                   MANUAL MOTOR   |
| OFF                                                        10 ON          |
| M-MCOF10                                                   MM10ON         |
|   N7:0                                                       N7:23        |
|--+--| |--+---------------------------------------------------(U)----------|
|  |   10  |                                                     8          |
|  |[3]    |                                                                |
|  |       | N7:23/8 - -| |- - File #2 MAIN_PRGRM - 258, 260                |
|  |       |           -|/|- - File #2 MAIN_PRGRM - 539                     |
|  |       |           -(L)- - File #2 MAIN_PRGRM - 520                     |
|  |       | _F:N7:21LX21 - BTW - File #2 MAIN_PRGRM - 2                    |
|  |PREPARE FOR                                                             |
|  |AUTO RUN                                                                |
|  |>AUTO  |                                                                |
|  |  N7:37|                                                                |
|  +--| |--+                                                                |
|      1                                                                   |
| [162]                                                                     |
```

```
Rung #559
| MANUAL                                                              |
| CONTROL                                              MANUAL MOTOR   |
| MOTOR 11                                             11 ON          |
| OFF                                                  MM11ON         |
| M-MCOF11                                               N7:23        |
|    N7:0                                                             |
|---] [---+-----------------------------------------------(U)---------|
| |   11  |                                                9          |
| |[3]    |                                                           |
| |       | N7:23/9 - ] [ - File #2 MAIN_PRGRM - 263, 265             |
| |       |           ]/[ - File #2 MAIN_PRGRM - 540                  |
| |       |           (L)- - File #2 MAIN_PRGRM - 521                 |
| |       | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2               |
| |PREPARE FOR                                                        |
| |AUTO RUN                                                           |
| |>AUTO  |                                                           |
| |  N7:37|                                                           |
| +---] [-+                                                           |
|      1                                                              |
| [162]                                                               |
Rung #560
| MANUAL                                                              |
| CONTROL                                              MANUAL MOTOR   |
| MOTOR 12                                             12 ON          |
| OFF                                                  MM12ON         |
| M-MCOF12                                               N7:23        |
|    N7:0                                                             |
|---] [---+-----------------------------------------------(U)---------|
| |   12  |                                                10         |
| |[3]    |                                                           |
| |       | N7:23/10 - ] [ - File #2 MAIN_PRGRM - 281                 |
| |       |            ]/[ - File #2 MAIN_PRGRM - 541                 |
| |       |            (L)- - File #2 MAIN_PRGRM - 522                |
| |       | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2               |
| |PREPARE FOR                                                        |
| |AUTO RUN                                                           |
| |>AUTO  |                                                           |
| |  N7:37|                                                           |
| +---] [-+                                                           |
|      1                                                              |
| [162]                                                               |
Rung #561
| MANUAL                                                              |
| CONTROL                                              MANUAL MOTOR   |
| MOTOR 13                                             13 ON          |
| OFF                                                  MM13ON         |
| M-MCOF13                                               N7:23        |
|    N7:0                                                             |
|---] [---+-----------------------------------------------(U)---------|
| |   13  |                                                11         |
| |[3]    |                                                           |
| |       | N7:23/11 - ] [ - File #2 MAIN_PRGRM - 285, 287            |
| |       |            ]/[ - File #2 MAIN_PRGRM - 542                 |
| |       |            (L)- - File #2 MAIN_PRGRM - 523                |
| |       | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2               |
| |PREPARE FOR                                                        |
| |AUTO RUN                                                           |
| |>AUTO  |                                                           |
| |  N7:37|                                                           |
| +---] [-+                                                           |
|      1                                                              |
| [162]                                                               |
```

```
Rung #562
| MANUAL
| CONTROL
| MOTOR 14                                                                    MANUAL MOTOR
| OFF                                                                         14 ON
| M-MCOF14                                                                    MM14ON
|    N7:0                                                                       N7:23
|-+--| |--+--------------------------------------------------------------------(U)----|
| |   14  |                                                                      12
| |[3]     |
| |         | N7:23/12 - -| |- - File #2 MAIN_PRGRM - 290, 292
| |         |            -|/|- - File #2 MAIN_PRGRM - 543
| |         |            -(L)- - File #2 MAIN_PRGRM - 524
| |         | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2
| |PREPARE FOR
| |AUTO RUN |
| |>AUTO    |
| |   N7:37 |
| +---| |---+
|       1
| [162]
Rung #563
| MANUAL
| CONTROL
| MOTOR 15                                                                    MANUAL MOTOR
| OFF                                                                         15 ON
| M-MCOF15                                                                    MM15ON
|    N7:0                                                                       N7:23
|-+--| |--+--------------------------------------------------------------------(U)----|
| |   15  |                                                                      13
| |[3]     |
| |         | N7:23/13 - -| |- - File #2 MAIN_PRGRM - 295, 297
| |         |            -|/|- - File #2 MAIN_PRGRM - 544
| |         |            -(L)- - File #2 MAIN_PRGRM - 525
| |         | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2
| |PREPARE FOR
| |AUTO RUN |
| |>AUTO    |
| |   N7:37 |
| +---| |---+
|       1
| [162]
Rung #564
| MANUAL
| CONTROL
| MOTOR 16                                                                    MANUAL MOTOR
| OFF                                                                         16 ON
| M-MCOF16                                                                    MM16ON
|    N7:1                                                                       N7:23
|-+--| |--+--------------------------------------------------------------------(U)----|
| |   0   |                                                                      14
| |[3]     |
| |         | N7:23/14 - -| |- - File #2 MAIN_PRGRM - 306
| |         |            -|/|- - File #2 MAIN_PRGRM - 545
| |         |            -(L)- - File #2 MAIN_PRGRM - 526
| |         | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2
| |PREPARE FOR
| |AUTO RUN |
| |>AUTO    |
| |   N7:37 |
| +---| |---+
|       1
| [162]
```

Rung #565

```
| MANUAL
| CONTROL                                                                          MANUAL MOTOR |
| MOTOR 17                                                                         17 ON        |
| OFF                                                                              MM17ON       |
| M-MCOF17                                                                            N7:23     |
|   N7:1                                                                                        |
|---] [----------------------------------------------------------------------------(U)---------|
| |  1         |                                                                      15         |
| |[3]         |                                                                                 |
| |            | N7:23/15 - ] [ - File #2 MAIN_PRGRM - 310, 312                                  |
| |            |            ]/[ - File #2 MAIN_PRGRM - 546                                       |
| |            |            -(L)- - File #2 MAIN_PRGRM - 527                                     |
| |            | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                                     |
| |PREPARE FOR |                                                                                 |
| |AUTO RUN    |                                                                                 |
| |>AUTO       |                                                                                 |
| |    N7:37   |                                                                                 |
| |-----] [----|                                                                                 |
|        1                                                                                       |
| [162]                                                                                          |
```

Rung #566

```
| MANUAL
| CONTROL                                                                          MANUAL MOTOR |
| MOTOR 18                                                                         18 ON        |
| OFF                                                                              MM18ON       |
| M-MCOF18                                                                            N7:24     |
|   N7:1                                                                                        |
|---] [----------------------------------------------------------------------------(U)---------|
| |  2         |                                                                      0          |
| |[3]         |                                                                                 |
| |            | N7:24/0 - ] [ - File #2 MAIN_PRGRM - 315, 317                                   |
| |            |           ]/[ - File #2 MAIN_PRGRM - 547                                        |
| |            |           -(L)- - File #2 MAIN_PRGRM - 528                                      |
| |            | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                                     |
| |PREPARE FOR |                                                                                 |
| |AUTO RUN    |                                                                                 |
| |>AUTO       |                                                                                 |
| |    N7:37   |                                                                                 |
| |-----] [----|                                                                                 |
|        1                                                                                       |
| [162]                                                                                          |
```

Rung #567

```
| MANUAL
| CONTROL                                                                          MANUAL MOTOR |
| MOTOR 19                                                                         19 ON        |
| OFF                                                                              MM19ON       |
| M-MCOF19                                                                            N7:24     |
|   N7:1                                                                                        |
|---] [----------------------------------------------------------------------------(U)---------|
| |  3         |                                                                      1          |
| |[3]         |                                                                                 |
| |            | N7:24/1 - ] [ - File #2 MAIN_PRGRM - 320, 322                                   |
| |            |           ]/[ - File #2 MAIN_PRGRM - 548                                        |
| |            |           -(L)- - File #2 MAIN_PRGRM - 529                                      |
| |            | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                                     |
| |PREPARE FOR |                                                                                 |
| |AUTO RUN    |                                                                                 |
| |>AUTO       |                                                                                 |
| |    N7:37   |                                                                                 |
| |-----] [----|                                                                                 |
|        1                                                                                       |
| [162]                                                                                          |
```

441

Rung #568

```
| MANUAL
| CONTROL
| MOTOR 20                                                    MANUAL MOTOR
| OFF                                                         20 ON
| M-MCOF20                                                    MM20ON
|     N7:1                                                       N7:24
|--+--] [--+--------------------------------------------------------(U)----|
|  |   4   |                                                        2
|  |[3]    |
|  |       | N7:24/2 - ] [ - File #2 MAIN_PRGRM - 331, 333
|  |       |           ]/[ - File #2 MAIN_PRGRM - 549, 550
|  |       |           -(L)- - File #2 MAIN_PRGRM - 530
|  |       | _F:N7:211%21 - BTW - File #2 MAIN_PRGRM - 2
|  |PREPARE FOR
|  |AUTO RUN
|  |>AUTO  |
|  |   N7:37
|  +--] [--+
|       1
|  [162]
```

Rung #569

```
| MANUAL
| CONTROL
| MOTOR 21                                                    MANUAL MOTOR
| OFF                                                         21 ON
| M-MCOF21                                                    MM21ON
|     N7:1                                                       N7:24
|--+--] [--+--------------------------------------------------------(U)----|
|  |   5   |                                                        3
|  |[3]    |
|  |       | N7:24/3 - ] [ - File #2 MAIN_PRGRM - 355, 357
|  |       |           -(L)- - File #2 MAIN_PRGRM - 531
|  |       | _F:N7:211%21 - BTW - File #2 MAIN_PRGRM - 2
|  |PREPARE FOR
|  |AUTO RUN
|  |>AUTO  |
|  |   N7:37
|  +--] [--+
|       1
|  [162]
```

Rung #570

```
|MOTOR 3                                                        MOTOR 3
|REVERSE                                                        REVERSE
|ENABLE                                                         M3R
|M3RE                                                           B3
| N7:19
|--| |-----------------------------------------------------------(L)--
| 2                                                             103
|[3]
|                                                               MANUAL
| B3/103 - -| |- - File #2 MAIN_PRGRM - 187                     MOTOR 3
|          -|/|- - File #2 MAIN_PRGRM - 185                     REVERSE
|          -(U)- - File #2 MAIN_PRGRM - 589                     ENABLE
| N7:40/2 - -(U)- - File #2 MAIN_PRGRM - 589                    MM3RE
| _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2                   N7:40
| N7:34/15 - -(L)- - File #2 MAIN_PRGRM - 589                   -(L)-
| _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2                   2
|                                                               MANUAL
|                                                               MOTOR 3
|                                                               REVERSE
|                                                               DISABLE
|                                                               MM3RD
|                                                               N7:34
|                                                               -(U)-
|                                                               15
```

Rung #571

```
|MOTOR 4                                                        MOTOR 4
|REVERSE                                                        REVERSE
 ENABLE                                                         M4R
|M4RE                                                           B3
| N7:19
|--| |-----------------------------------------------------------(L)--
| 3                                                             104
|[3]
|                                                               MANUAL
| B3/104 - -| |- - File #2 MAIN_PRGRM - 192                     MOTOR 4
|          -|/|- - File #2 MAIN_PRGRM - 190                     REVERSE
|          -(U)- - File #2 MAIN_PRGRM - 590                     ENABLE
| N7:40/3 - -(U)- - File #2 MAIN_PRGRM - 590                    MM4RE
| _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2                   N7:40
| N7:35/0 - -(L)- - File #2 MAIN_PRGRM - 590                    -(L)-
| _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2                   3
|                                                               MANUAL
|                                                               MOTOR 4
|                                                               REVERSE
|                                                               DISABLE
|                                                               MM4RD
|                                                               N7:35
|                                                               -(U)-
|                                                               0
```

Rung #572

```
|MOTOR 5                                                                                          |
|REVERSE                                                                          MOTOR 5         |
|ENABLE                                                                           REVERSE         |
|M5RE                                                                             M5R             |
|  N7:19                                                                            B3            |
|---] [-----------------------------------------------------------------------+----(L)--------+-|
|    4                                                                        |    105        | |
|[3]                                                                          |               | |
|                                                                             |MANUAL         | |
| B3/105 - ] [ - File #2 MAIN_PRGRM - 197                                     |MOTOR 5        | |
|          ]/[ - File #2 MAIN_PRGRM - 195                                     |REVERSE        | |
|          -(U)- - File #2 MAIN_PRGRM - 591                                   |ENABLE         | |
| N7:40/4 - -(U)- - File #2 MAIN_PRGRM - 591                                  |MM5RE          | |
| _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2                                 |  N7:40        | |
| N7:35/1 - -(L)- - File #2 MAIN_PRGRM - 591                                  +----(L)--------+ |
| _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2                                 |     4         | |
|                                                                             |MANUAL         | |
|                                                                             |MOTOR 5        | |
|                                                                             |REVERSE        | |
|                                                                             |DISABLE        | |
|                                                                             |MM5RD          | |
|                                                                             |  N7:35        | |
|                                                                             +----(U)--------+ |
|                                                                                   1             |
```

Rung #573

```
|MOTOR 6                                                                                          |
|REVERSE                                                                          MOTOR 6         |
|ENABLE                                                                           REVERSE         |
|M6RE                                                                             M6R             |
|  N7:19                                                                            B3            |
|---] [-----------------------------------------------------------------------+----(L)--------+-|
|    5                                                                        |    106        | |
|[3]                                                                          |               | |
|                                                                             |MANUAL         | |
| B3/106 - ] [ - File #2 MAIN_PRGRM - 220                                     |MOTOR 6        | |
|          ]/[ - File #2 MAIN_PRGRM - 218                                     |REVERSE        | |
|          -(U)- - File #2 MAIN_PRGRM - 592                                   |ENABLE         | |
| N7:40/5 - -(U)- - File #2 MAIN_PRGRM - 592                                  |MM6RE          | |
| _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2                                 |  N7:40        | |
| N7:35/2 - -(L)- - File #2 MAIN_PRGRM - 592                                  +----(L)--------+ |
| _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2                                 |     5         | |
|                                                                             |MANUAL         | |
|                                                                             |MOTOR 6        | |
|                                                                             |REVERSE        | |
|                                                                             |DISABLE        | |
|                                                                             |MM6RD          | |
|                                                                             |  N7:35        | |
|                                                                             +----(U)--------+ |
|                                                                                   2             |
```

Rung #574

```
|MOTOR 7                                                          MOTOR 7
|REVERSE                                                          REVERSE
|ENABLE                                                           M7R
|M7RE                                                               B3
| N7:19
|---| |-------------------------------------------------------------+--(L)--+
|   6                                                               |  107  |
|[3]                                                                |       |
|                                                                   |MANUAL |
| B3/107 - -| |- - File #2 MAIN_PRGRM - 233                          |MOTOR 7|
|          -|/|- - File #2 MAIN_PRGRM - 231                          |REVERSE|
|          -(U)- - File #2 MAIN_PRGRM - 593                          |ENABLE |
| N7:40/6 - -(U)- - File #2 MAIN_PRGRM - 593                         |MM7RE  |
| _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                        | N7:40 |
| N7:35/3 - -(L)- - File #2 MAIN_PRGRM - 593                         +--(L)--+
| _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                        |   6   |
|                                                                   |MANUAL |
|                                                                   |MOTOR 7|
|                                                                   |REVERSE|
|                                                                   |DISABLE|
|                                                                   |MM7RD  |
|                                                                   | N7:35 |
|                                                                   +--(U)--+
                                                                        3
```

Rung #575

```
|MOTOR 8                                                          MOTOR 8
 EVERSE                                                           REVERSE
|ENABLE                                                           M8R
|M8RE                                                               B3
| N7:19
|---| |-------------------------------------------------------------+--(L)--+
|   7                                                               |  108  |
|[3]                                                                |       |
|                                                                   |MANUAL |
| B3/108 - -| |- - File #2 MAIN_PRGRM - 249                          |MOTOR 8|
|          -|/|- - File #2 MAIN_PRGRM - 249                          |REVERSE|
|          -(U)- - File #2 MAIN_PRGRM - 594                          |ENABLE |
| N7:40/7 - -(U)- - File #2 MAIN_PRGRM - 594                         |MM8RE  |
| _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                        | N7:40 |
| N7:35/4 - -(L)- - File #2 MAIN_PRGRM - 594                         +--(L)--+
| _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                        |   7   |
|                                                                   |MANUAL |
|                                                                   |MOTOR 8|
|                                                                   |REVERSE|
|                                                                   |DISABLE|
|                                                                   |MM8RD  |
|                                                                   | N7:35 |
|                                                                   +--(U)--+
                                                                        4
```

445

```
Rung #576
|MOTOR 9                                                                  MOTOR 9
|REVERSE                                                                  REVERSE
|ENABLE                                                                   M9R
|M9RE                                                                       B3
| N7:19
|---| |-------------------------------------------------------------------+---(L)----+-
|   8                                                                     |   109    |
|[3]                                                                      |          |
|                                                                         |MANUAL    |
| B3/109 - -| |- - File #2 MAIN_PRGRM - 255                               |MOTOR 9   |
|           -|/|- - File #2 MAIN_PRGRM - 253                              |REVERSE   |
|           -(U)- - File #2 MAIN_PRGRM - 595                              |ENABLE    |
| N7:40/8 - -(U)- - File #2 MAIN_PRGRM - 595                              |MM9RE     |
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                             | N7:40    |
| N7:35/5 - -(L)- - File #2 MAIN_PRGRM - 595                              +---(L)----+
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                             |   8      |
|                                                                         |MANUAL    |
|                                                                         |MOTOR 9   |
|                                                                         |REVERSE   |
|                                                                         |DISABLE   |
|                                                                         |MM9RD     |
|                                                                         | N7:35    |
|                                                                         +---(U)----+
|                                                                             5
Rung #577
|MOTOR 10
|REVERSE                                                                  MOTOR 10
|ENABLE                                                                   REVERSE
|M10RE                                                                    M10R
| N7:19                                                                     B3
|---| |-------------------------------------------------------------------+---(L)----+-
|   9                                                                     |   110    |
|[3]                                                                      |          |
|                                                                         |MANUAL    |
| B3/110 - -| |- - File #2 MAIN_PRGRM - 260                               |MOTOR 10  |
|           -|/|- - File #2 MAIN_PRGRM - 258                              |REVERSE   |
|           -(U)- - File #2 MAIN_PRGRM - 596                              |ENABLE    |
| N7:40/9 - -(U)- - File #2 MAIN_PRGRM - 596                              |MM10RE    |
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                             | N7:40    |
| N7:35/6 - -(L)- - File #2 MAIN_PRGRM - 596                              +---(L)----+
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                             |   9      |
|                                                                         |MANUAL    |
|                                                                         |MOTOR 10  |
|                                                                         |REVERSE   |
|                                                                         |DISABLE   |
|                                                                         |MM10RD    |
|                                                                         | N7:35    |
|                                                                         +---(L)----+
|                                                                             6
```

```
Rung #578
|MOTOR 11                                                    MOTOR 11   |
|REVERSE                                                     REVERSE    |
|ENABLE                                                      M11R       |
|M11RE                                                          B3      |
| N7:19                                                                 |
|--| |-------------------------------------------------------+---(L)--+-|
|   10                                                       |   111   | |
|[3]                                                         |         | |
|                                                            |MANUAL   | |
| B3/111 - -| |- - File #2 MAIN_PRGRM - 265                   |MOTOR 11 | |
|          -|/|- - File #2 MAIN_PRGRM - 263                   |REVERSE  | |
|          -(U)- - File #2 MAIN_PRGRM - 597                   |ENABLE   | |
| N7:40/10 - -(U)- - File #2 MAIN_PRGRM - 597                 |MM11RE   | |
| _F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2                 | N7:40   | |
| N7:35/7 - -(L)- - File #2 MAIN_PRGRM - 597                  +---(L)---+ |
| _F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2                 |   10    | |
|                                                            |MANUAL   | |
|                                                            |MOTOR 11 | |
|                                                            |REVERSE  | |
|                                                            |DISABLE  | |
|                                                            |MM11RD   | |
|                                                            | N7:35   | |
|                                                            +---(U)---+ |
|                                                                 7      |
Rung #579
|MOTOR 12                                                    MOTOR 12   |
|REVERSE                                                     REVERSE    |
|ENABLE                                                      M12R       |
|M12RE                                                          B3      |
| N7:19                                                                 |
|--| |-------------------------------------------------------+---(L)--+-|
|   11                                                       |   112   | |
|[3]                                                         |         | |
|                                                            |MANUAL   | |
| B3/112 - -| |- - File #2 MAIN_PRGRM - 281                   |MOTOR 12 | |
|          -|/|- - File #2 MAIN_PRGRM - 281                   |REVERSE  | |
|          -(U)- - File #2 MAIN_PRGRM - 598                   |ENABLE   | |
| N7:40/11 - -(U)- - File #2 MAIN_PRGRM - 598                 |MM12RE   | |
| _F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2                 | N7:40   | |
| N7:35/8 - -(L)- - File #2 MAIN_PRGRM - 598                  +---(L)---+ |
| _F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2                 |   11    | |
|                                                            |MANUAL   | |
|                                                            |MOTOR 12 | |
|                                                            |REVERSE  | |
|                                                            |DISABLE  | |
|                                                            |MM12RD   | |
|                                                            | N7:35   | |
|                                                            +---(U)---+ |
|                                                                 8      |
```

447

Rung #580

```
|MOTOR 13                                                              MOTOR 13
|REVERSE                                                               REVERSE
|ENABLE                                                                M13R
|M13RE                                                                   B3
|  N7:19
|---] [----------------------------------------------------------------+--(L)--+
|     12                                                               |  113  |
|[3]                                                                   |       |
|                                                                      |MANUAL |
| B3/113 - ] [ - File #2 MAIN_PRGRM - 287                               |MOTOR 13
|          ]/[ - File #2 MAIN_PRGRM - 285                               |REVERSE
|          -(U)- - File #2 MAIN_PRGRM - 599                             |ENABLE
| N7:40/12 - -(U)- - File #2 MAIN_PRGRM - 599                           |MM13RE
| _F:N7:211%21 - BTW - File #2 MAIN_PRGRM - 2                           | N7:40
| N7:35/9 - -(L)- - File #2 MAIN_PRGRM - 599                            +--(L)--+
| _F:N7:211%21 - BTW - File #2 MAIN_PRGRM - 2                           |  12   |
|                                                                      |MANUAL |
|                                                                      |MOTOR 13
|                                                                      |REVERSE
|                                                                      |DISABLE
|                                                                      |MM13RD
|                                                                      | N7:35
|                                                                      +--(U)--+
                                                                           9
```

Rung #581

```
|MOTOR 14                                                              MOTOR 14
|REVERSE                                                               REVERSE
|ENABLE                                                                M14R
|M14RE                                                                   B3
|  N7:19
|---] [----------------------------------------------------------------+--(L)--+
|     13                                                               |  114  |
|[3]                                                                   |       |
|                                                                      |MANUAL |
| B3/114 - ] [ - File #2 MAIN_PRGRM - 292                               |MOTOR 14
|          ]/[ - File #2 MAIN_PRGRM - 290                               |REVERSE
|          -(U)- - File #2 MAIN_PRGRM - 600                             |ENABLE
| N7:40/13 - -(U)- - File #2 MAIN_PRGRM - 600                           |MM14RE
| _F:N7:211%21 - BTW - File #2 MAIN_PRGRM - 2                           | N7:40
| N7:35/10 - -(L)- - File #2 MAIN_PRGRM - 600                           +--(L)--+
| _F:N7:211%21 - BTW - File #2 MAIN_PRGRM - 2                           |  13   |
|                                                                      |MANUAL |
|                                                                      |MOTOR 14
|                                                                      |REVERSE
|                                                                      |DISABLE
|                                                                      |MM14RD
|                                                                      | N7:35
|                                                                      +--(U)--+
                                                                           10
```

```
Rung #692
                                                    EXLOCK
|VENT-PUMP                                          CHAMBER                                PUMPDOWN
|CYCLE EXIT  DOOR 12   DOOR 11   THREE CYCLES       PRESSUR AT    VENT                     EXIT LOCK
|LOCK        CLOSED    CLOSED    COMPLETE           ATMOSPHERE    EXIT LOCK                CLEAN CYCLE
|VNT-PD-EX   DRCL12S   DRCL11S   EX-CCC             PS6           VNT-EX                   PD-EX-CC
|  N7:27     I:056     I:056     C5:11              I:052         B3                       B3
|---] [-------] [-------] [--------]/[---------------] [-----------]/[---------------------(L)---|
|    9         06        04         DN                 04           498                    497
|[691]                            [696]                          [694]
B3/497 - ] [ - File #2 MAIN_PRGRM - 337,340,367
         -(L)- - File #2 MAIN_PRGRM - 692
         -(U)- - File #2 MAIN_PRGRM - 693

Rung #693
|              EXITLOCK
|  VENT-PUMP   CHAMBER                                                                    PUMPDOWN
|  CYCLE EXIT  <250                                                                       EXIT LOCK
|  LOCK        MICRONS                                                                    CLEAN CYCLE
|  VNT-PD-EX   PIR17                                                                      PD-EX-CC
|    N7:27     I:054                                                                      B3
|--+---] [-------] [---+-----------------------------------------------------------------(U)---|
|  |     9         10  |                                                                  497
|  |[691]              |
|  |                   | B3/497 - ] [ - File #2 MAIN_PRGRM - 337, 340, 367
|  |                   |          -(L)- - File #2 MAIN_PRGRM - 692
|  |PAUSE              |
|  |DISABLE            |
|  |TS12               |
|  |  N7:16            |
|  +---] [-------------+
|        4
|  [3]

Rung #694
|          EXITLOCK  EXLOCK
|VENT-PUMP CHAMBER   CHAMBER                                                               VENT
|CYCLE EXIT <250     PRESSUR AT   THREE CYCLES                                             EXIT LOCK
|LOCK       MICRONS  ATMOSPHERE   COMPLETE                                                 VNT-EX
|VNT-PD-EX  PIR17    PS6          EX-CCC                                                   B3
|  N7:27    I:054    I:052        C5:11
|---] [------] [-------]/[----------]/[--------------------------------------------------(L)---|
|    9        10       04           DN                                                    498
|[691]                          [696]
B3/498 - ] [ - File #2 MAIN_PRGRM - 346,367
         ]/[ - File #2 MAIN_PRGRM - 692,696
         -(L)- - File #2 MAIN_PRGRM - 694
         -(U)- - File #2 MAIN_PRGRM - 695
```

449

```
Rung #689
|            EXLOCK      OPEN
|            CHAMBER     EXLOCK
| VENT       PRESSUR AT  CHAMBER                                                                          VENT
| EXIT LOCK  ATMOSPHERE  VENT VALVE                                                                       EXIT LOCK
| VNTEX      PS6         CVS                                                                              VNTEX
|   N7:27      I:052       O:057                                                                          N7:27
|---| |--------| |---------|/|---------------------------------------------------------------------------(U)---
| |   8          04          16    |                                                                        8
| |[689]                    [367]  |
| |                                | N7:27/8 - -| |- - File #2 MAIN_PRGRM - 337, 339, 346, 689
| |                                |             -|/|- - File #2 MAIN_PRGRM - 690, 698
| |                                |             -(L)- - File #2 MAIN_PRGRM - 688
| |PUMP DOWN                       | _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2
| |EXIT LOCK                       |
| |PUSH BUTTON                     |
| |PDEXPB                          |
| |   N7:6                         |
| |---| |------------------------- |
| |    10                          |
| |[3]                             |
| |PAUSE                           |
| |DISABLE                         |
| |TS12                            |
| |  N7:16                         |
| |---| |------------------------- |
|      4
  [3]
Rung #690
|VENT-PUMP                                      EXLOCK
|CYCLE EXIT  AUTO                               CHAMBER                                          VENT-PUMP
|LOCK        MODE    VENT        PUMP DOWN      PRESSUR AT                                       CYCLE EXIT
|PUSHBUTTON  ENABLE  EXIT LOCK   EXIT LOCK      ATMOSPHERE                                       LOCK
|V-P-EXPB    AUTO    VNTEX       PDEX           PS6                                              VNT-PD-EX
|   N7:6      N7:37    N7:27       N7:27          I:052                                            N7:27
|----| |-------|/|------|/|---------|/|-----------| |---------------------------------------------(L)---
|     9        11       8           10           04                                                 9
|[3]          [158]   [689]        [698]
N7:27/9 - -| |- - File #2 MAIN_PRGRM -  78,339,351,691,692,693,694,695,696
          -|/|- - File #2 MAIN_PRGRM -  688,697,698
          -(L)- - File #2 MAIN_PRGRM -  690
          -(U)- - File #2 MAIN_PRGRM -  691
_F:N7:211X21 - BTW - File #2 MAIN_PRGRM -  2
Rung #691
| VENT-PUMP                                                                                     VENT-PUMP
| CYCLE EXIT  DOOR 12                                                                           CYCLE EXIT
| LOCK        OPEN                                                                              LOCK
| VNT-PD-EX   DROP12S                                                                           VNT-PD-EX
|   N7:27       I:056                                                                             N7:27
|----| |---------| |-----------------------------------------------------------------------------(U)---
| |    9          07    |                                                                            9
| |[691]                |
| |                     | N7:27/9 - -| |- - File #2 MAIN_PRGRM - 78, 339, 351, 691, 692, 693, 694, 695, 696
| |                     |           -|/|- - File #2 MAIN_PRGRM - 688, 697, 698
| |                     |           -(L)- - File #2 MAIN_PRGRM - 690
| |                     | _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2
| |PAUSE                |
| |DISABLE              |
| |TS12                 |
| |  N7:16              |
| |---| |---------------|
|      4
|  [3]
```

```
Rung #695
|             EXLOCK      OPEN                                                                      |
| VENT-PUMP   CHAMBER     EXLOCK                                                                    |
| CYCLE EXIT  PRESSUR AT  CHAMBER                                                        VENT       |
| LOCK        ATMOSPHERE  VENT VALVE                                                     EXIT LOCK  |
| VNT-PD-EX   PS6         CV5                                                            VNT-EX     |
|   N7:27       I:052       O:057                                                          B3       |
|-+---| |---------| |---------|/|---+-------------------------------------------------------(U)------|
| |     9           04          16  |                                                      498      |
| |[691]                     [367]  |                                                               |
| |                                 | B3/498 - -| |- - File #2 MAIN_PRGRM - 346, 367                  |
| |                                 |          -|/|- - File #2 MAIN_PRGRM - 692, 696                  |
| |                                 |          -(L)- - File #2 MAIN_PRGRM - 694                     |
| |PAUSE                            |                                                               |
| |DISABLE                          |                                                               |
| |TS12                             |                                                               |
| |  N7:16                          |                                                               |
| +---| |---------------------------+                                                               |
|      4                                                                                            |
| [3]                                                                                               |
Rung #696
|                            EXLOCK                                                                 |
|VENT-PUMP                   CHAMBER                                         EXIT LOCK              |
|CYCLE EXIT  VENT            PRESSUR AT                                      CLEAN CYCLE            |
|LOCK        EXIT LOCK       ATMOSPHERE                                      COUNTER                |
|VNT-PD-EX   VNT-EX          PS6                                             EX-CCC                 |
|  N7:27        B3             I:052                                         +-CTU----------+       |
|---| |---------|/|------------| |---------------------------------------------|COUNT UP      |-(CU)-|
|     9          498             04                                          |COUNTER: C5:11|       |
|[691]         [695]                                                         |PRESET:      4|-(DN)  |
|                                                                            |ACCUM:       0|       |
|                                                                            +--------------+       |
C5:11 - CTU - File #2 MAIN_PRGRM - 696
        RES - File #2 MAIN_PRGRM - 697
C5:11.DN - -| |- - File #2 MAIN_PRGRM - 351
           -|/|- - File #2 MAIN_PRGRM - 692,694
Rung #697
| VENT-PUMP                                                                         EXIT LOCK       |
| CYCLE EXIT  DOOR 12                                                               CLEAN CYCLE     |
| LOCK        OPEN                                                                  COUNTER         |
| VNT-PD-EX   DROP12S                                                               EX-CCC          |
|   N7:27       I:056                                                                  C5:11        |
|-+---|/|---------| |---+---------------------------------------------------------------[RES]--------|
| |     9           07  |                                                                           |
| |[691]                |                                                                           |
| |                     | C5:11 - CTU - File #2 MAIN_PRGRM - 696                                    |
| |                     | C5:11.DN - -| |- - File #2 MAIN_PRGRM - 351                               |
| |                     |            -|/|- - File #2 MAIN_PRGRM - 692, 694                           |
| |PAUSE                |                                                                           |
| |DISABLE              |                                                                           |
| |TS12                 |                                                                           |
| |  N7:16              |                                                                           |
| +---| |---------------+                                                                           |
|      4                                                                                            |
| [3]                                                                                               |
```

451

```
Rung #698
|                                        EXITLOCK                                              EXITLOCK                             |
| PUMP DOWN      AUTO                    CHAMBER     PIRINI                   VENT-PUMP        CHAMBER                              |
| EXIT LOCK      MODE       DOOR 11      <250        GUAGE 8     VENT         CYCLE EXIT       <250                      PUMP DOWN  |
| PUSH BUTTON    ENABLE     CLOSED      MICRONS     NO FAULT    EXIT LOCK    LOCK             MICRONS                   EXIT LOCK  |
| PDEXPB         AUTO       DRCL11S     PIR17       PGNF8       VNTEX        VNT-PD-EX        PIR17                     PDEX       |
|    N7:6        N7:37      I:056       I:054       I:054       N7:27        N7:27            I:054                       N7:27   |
|-+---| |---+----|/|--------| |--------|/|---------| |---------|/|----------|/|--------------|/|--------------------------(L)----|
| |    10    |     11         04          10          15          8            9                10                          10    |
| | [3]      |   [158]                                         [689]        [691]                                               |
| |VENT AREA |                                                                                                                  |
| |5 ENABLE  |                                                                                                                  |
| |VENT5E    |                                                                                                                  |
| |  N7:37   |                                                                                                                  |
| +---| |----+                                                                                                                  |
|      10                                                                                                                       |
| [433]                                                                                                                         |
N7:27/10 - -| |- - File #2 MAIN_PRGRM -  78,340,699
           -|/|- - File #2 MAIN_PRGRM -  109,688,690
           -(L)- - File #2 MAIN_PRGRM -  698
           -(U)- - File #2 MAIN_PRGRM -  700
_F:N7:211%21 - BTW - File #2 MAIN_PRGRM -  2
Rung #699
|                 EXITLOCK                                                                                                      |
|                 CHAMBER                                                                              PUMPDOWN                 |
|PUMP DOWN        <250                                                                                 EXITLOCK                 |
|EXIT LOCK        MICRONS                                                                              COMPLETE                 |
| )EX             PIR17                                                                                PFEXEND                  |
|   N7:27          I:054                                                                               +-TON------------+       |
|----| |------+-----| |----+-----------------------------------------------------------------------------|TIMER ON DELAY  |-(EN)-|
|     10      |     10     |                                                                           |TIMER:    T4:222|       |
|[698]        |            |                                                                           |BASE (SEC):  1.0|-(DN) |
|             |            | T4:222.DN - -| |- - File #2 MAIN_PRGRM - 700                              |PRESET:        5|       |
|             |PIRINI      | T4:222.TT - -| |- - File #2 MAIN_PRGRM - 98                               |ACCUM:         0|       |
|             |GUAGE 8     |                                                                           +----------------+       |
|             |NO FAULT    |                                                                                                    |
|             |PGNF8       |                                                                                                    |
|             |   I:054    |                                                                                                    |
|             +----|/|-----+                                                                                                    |
|                  15                                                                                                           |
Rung #700
|                                                                                                                    PUMP DOWN  |
|                                                                                                                    EXIT LOCK  |
| PFEXEND                                                                                                            PDEX       |
|  T4:222                                                                                                               N7:27   |
|-+---| |----+----------------------------------------------------------------------------------------------------------(U)----|
| |    DN    |                                                                                                            10    |
| |[699]     |                                                                                                                  |
| |          | N7:27/10 - -| |- - File #2 MAIN_PRGRM - 78, 340, 699                                                             |
| |          |           -|/|- - File #2 MAIN_PRGRM - 109, 688, 690                                                             |
| |          |           -(L)- - File #2 MAIN_PRGRM - 698                                                                       |
| |          | _F:N7:211%21 - BTW - File #2 MAIN_PRGRM - 2                                                                         |
| |PAUSE     |                                                                                                                  |
| |DISABLE   |                                                                                                                  |
| |TS12      |                                                                                                                  |
| |  N7:16   |                                                                                                                  |
| +---| |----+                                                                                                                  |
|      4                                                                                                                        |
| [3]                                                                                                                           |
```

Rung #686

PUMPDOWN LOADLOCK PDLL N7:24 15 [687]

LOAD LOCK CHAMBER =<250 MICRONS PIR1 I:004 07

PIRANI GUAGE 1 NO FAULT PGNF1 I:004 14

T4:287.DN - ⊣ ⊢ - File #2 MAIN_PRGRM - 687
T4:287.TT - ⊣ ⊢ - File #2 MAIN_PRGRM - 84

PUMPDOWN LOADLOCK DISABLE PULSE PDLLDPLSE

TON
TIMER ON DELAY (EN)
TIMER: T4:287
BASE (SEC): 1.0 (DN)
PRESET: 5
ACCUM: 0

Rung #687

PDLLDPLSE T4:287 DN [686]

PAUSE DISABLE TS12 N7:16 4 [3]

N7:24/15 - ⊣ ⊢ - File #2 MAIN_PRGRM - 68, 167, 675, 685, 686
⊣/⊢ - File #2 MAIN_PRGRM - 167, 674, 676
-(L)- - File #2 MAIN_PRGRM - 684
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2

PUMPDOWN LOADLOCK PDLL N7:24 -(U)- 15

Rung #688

VENT EXITLOCK PUSHBUTTON VNTEXPB N7:6 8 [3]

AUTO MODE ENABLE AUTO N7:37 11 [158]

VENT-PUMP CYCLE EXIT LOCK VNT-PD-EX N7:27 9 [690]

PUMP DOWN EXIT LOCK PDEX N7:27 10 [698]

EXLOCK CHAMBER PRESSUR AT ATMOSPHERE PS6 I:052 04

VENT EXIT LOCK VNTEX N7:27 -(L)- 8

N7:27/8 - ⊣ ⊢ - File #2 MAIN_PRGRM - 337,339,346,689
⊣/⊢ - File #2 MAIN_PRGRM - 690,698
-(L)- - File #2 MAIN_PRGRM - 688
-(U)- - File #2 MAIN_PRGRM - 689
_F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2

```
Rung #701
|MANUAL
|CONTROL                                                          MANUAL
|CHAMBER                                                          CHAMBER
|VENT 1                                                           VENT 1
|CLOSE                                                            CLOSE
|M-CV1-0                                                          MCVNT1CL
| N7:4                                                             N7:25
|--| |---------------------------------------------------------+----(L)----
|  0                                                           |    0     |
|[3]                                                           |          |
|                                                              |MANUAL    |
| N7:25/0 - -(U)- - File #2 MAIN_PRGRM - 706                   |CHAMBER   |
| _F:N7:21[X21 - BTV - File #2 MAIN_PRGRM - 2                  |VENT 1    |
| N7:27/11 - -(L)- - File #2 MAIN_PRGRM - 706                  |OPEN      |
| _F:N7:21[X21 - BTV - File #2 MAIN_PRGRM - 2                  |MCVNT1OP  |
|                                                              | N7:27    |
|                                                              +---(U)----+
|                                                                   11

Rung #702
|MANUAL
|CONTROL                                                          MANUAL
|CHAMBER                                                          CHAMBER
|VENT VALVE                                                       VENT 2
|CLOSE                                                            CLOSE
|M-CV2-0                                                          MCVNT2CL
|     N7:4                                                         N7:25
   --| |-------------------------------------------------------+----(L)----
|      1                                                       |    1     |
|[3]                                                           |          |
|                                                              |MANUAL    |
| N7:25/1 - -(U)- - File #2 MAIN_PRGRM - 707                   |CHAMBER   |
| _F:N7:21[X21 - BTV - File #2 MAIN_PRGRM - 2                  |VENT 2    |
| N7:27/12 - -(L)- - File #2 MAIN_PRGRM - 707                  |OPEN      |
| _F:N7:21[X21 - BTV - File #2 MAIN_PRGRM - 2                  |MCVNT2OP  |
|                                                              | N7:27    |
|                                                              +---(U)----+
|                                                                   12

Rung #703
|MANUAL
|CONTROL                                                          MANUAL
|CHAMBER                                                          CHAMBER
|VENT VALVE                                                       VENT 3
|CLOSE                                                            CLOSE
|M-CV3-0                                                          MCVNT3CL
|     N7:4                                                         N7:25
|----| |-------------------------------------------------------+----(L)----
|      2                                                       |    2     |
|[3]                                                           |          |
|                                                              |MANUAL    |
| N7:25/2 - -(U)- - File #2 MAIN_PRGRM - 708                   |CHAMBER   |
| _F:N7:21[X21 - BTV - File #2 MAIN_PRGRM - 2                  |VENT 3    |
| N7:27/13 - -(L)- - File #2 MAIN_PRGRM - 708                  |OPEN      |
| _F:N7:21[X21 - BTV - File #2 MAIN_PRGRM - 2                  |MCVNT3OP  |
|                                                              | N7:27    |
|                                                              +---(U)----+
|                                                                   13
```

Rung #704

```
|MANUAL                                                    MANUAL
|CONTROL                                                   CHAMBER
|CHAMBER                                                   VENT 4
|VENT VALVE                                                CLOSE
|4 CLOSE                                                   MCVNT4CL
|M-CV4-0                                                    N7:25
|  N7:4
|--| |------------------------------------------------------(L)--
|   3                                                       3
|[3]
|                                                          MANUAL
| N7:25/3 - -(U)- - File #2 MAIN_PRGRM - 709               CHAMBER
| _F:N7:21(%21 - BTW - File #2 MAIN_PRGRM - 2              VENT 4
| N7:27/14 - -(L)- - File #2 MAIN_PRGRM - 709              OPEN
| _F:N7:21(%21 - BTW - File #2 MAIN_PRGRM - 2              MCVNT4OP
|                                                           N7:27
|                                                          --(U)--
|                                                            14
```

Rung #705

```
|MANUAL                                                    MANUAL
|CONTROL                                                   CHAMBER
|CHAMBER                                                   VENT 5
|VENT VALVE                                                CLOSE
|5 CLOSE                                                   MCVNT5CL
|M-CV5-0                                                    N7:25
|  N7:4
|--| |------------------------------------------------------(L)--
|   4                                                       4
|[3]
|                                                          MANUAL
| N7:25/4 - -(U)- - File #2 MAIN_PRGRM - 710               CHAMBER
| _F:N7:21(%21 - BTW - File #2 MAIN_PRGRM - 2              VENT 5
| N7:27/15 - -(L)- - File #2 MAIN_PRGRM - 710              OPEN
| _F:N7:21(%21 - BTW - File #2 MAIN_PRGRM - 2              MCVNT5OP
|                                                           N7:27
|                                                          --(U)--
|                                                            15
```

Rung #706

```
|MANUAL                                                    MANUAL
|CONTROL                                                   CHAMBER
|CHAMBER                                                   VENT 1
|VENT 1                                                    OPEN
|OPEN                                                      MCVNT1OP
|M-CV1-1                                                    N7:27
| N7:6
|--| |------------------------------------------------------(L)--
|  11                                                       11
|[3]
|                                                          MANUAL
| N7:27/11 - -(U)- - File #2 MAIN_PRGRM - 701              CHAMBER
| _F:N7:21(%21 - BTW - File #2 MAIN_PRGRM - 2              VENT 1
| N7:25/0 - -(L)- - File #2 MAIN_PRGRM - 701               CLOSE
| _F:N7:21(%21 - BTW - File #2 MAIN_PRGRM - 2              MCVNT1CL
|                                                           N7:25
|                                                          --(U)--
|                                                            0
```

455

Rung #707

```
|MANUAL
|CONTROL                                                   MANUAL
|CHAMBER                                                   CHAMBER
|VENT 2                                                    VENT 2
|OPEN                                                      OPEN
|M-CV2-1                                                   MCVNT2OP
|  N7:6                                                     N7:27
|---| |------------------------------------------------------+--(L)--+-
|    12                                                      |   12  |
|[3]                                                         |       |
|                                                            |MANUAL |
| N7:27/12 - -(U)- - File #2 MAIN_PRGRM - 702                |CHAMBER|
| _F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2                |VENT 2 |
| N7:25/1 - -(L)- - File #2 MAIN_PRGRM - 702                 |CLOSE  |
| _F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2                |MCVNT2CL
|                                                            | N7:25 |
|                                                            +--(U)--+
|                                                                1
```

Rung #708

```
|MANUAL
|CONTROL                                                   MANUAL
|CHAMBER                                                   CHAMBER
|VENT 3                                                    VENT 3
|OPEN                                                      OPEN
|M-CV3-1                                                   MCVNT3OP
|  N7:6                                                     N7:27
|---| |------------------------------------------------------+--(L)--+-
|    13                                                      |   13  |
|[3]                                                         |       |
|                                                            |MANUAL |
| N7:27/13 - -(U)- - File #2 MAIN_PRGRM - 703                |CHAMBER|
| _F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2                |VENT 3 |
| N7:25/2 - -(L)- - File #2 MAIN_PRGRM - 703                 |CLOSE  |
| _F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2                |MCVNT3CL
|                                                            | N7:25 |
|                                                            +--(U)--+
|                                                                2
```

Rung #709

```
|MANUAL
|CONTROL                                                   MANUAL
|CHAMBER                                                   CHAMBER
|VENT 4                                                    VENT 4
|OPEN                                                      OPEN
|M-CV4-1                                                   MCVNT4OP
|  N7:6                                                     N7:27
|---| |------------------------------------------------------+--(L)--+-
|    14                                                      |   14  |
|[3]                                                         |       |
|                                                            |MANUAL |
| N7:27/14 - -(U)- - File #2 MAIN_PRGRM - 704                |CHAMBER|
| _F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2                |VENT 4 |
| N7:25/3 - -(L)- - File #2 MAIN_PRGRM - 704                 |CLOSE  |
| _F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2                |MCVNT4CL
|                                                            | N7:25 |
|                                                            +--(U)--+
|                                                                3
```

```
Rung #710
|                                                                    MANUAL      |
|MANUAL CONTROL                                                      CHAMBER     |
|CHAMBER VENT 5                                                      VENT 5      |
|OPEN                                                                OPEN        |
|M-CVS-1                                                             MCVNT5OP    |
|      N7:6                                                            N7:27     |
|----] [------------------------------------------------------------+---(L)---+--|
|      15                                                           |    15    |  |
|[3]                                                                |          |  |
|                                                                   |MANUAL    |  |
| N7:27/15 - -(U)- - File #2 MAIN_PRGRM - 705                       |CHAMBER   |  |
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                       |VENT 5    |  |
| N7:25/4 - -(L)- - File #2 MAIN_PRGRM - 705                        |CLOSE     |  |
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                       |MCVNT5CL  |  |
|                                                                   |  N7:25   |  |
|                                                                   +---(U)----+  |
|                                                                        4        |
Rung #711
|                   WATER TEST                                     WATER FLOW    |
|                   LOCK                                           SWITCH TEST   |
|  AUTOPULSE        H20_TST_LOK                                    WFS_TST       |
|   T4:282             B3                                              B3        |
|-+--] [------+-------] [----------------------------------------------(L)-------|
| |    TT     |       33                                              281        |
| |[158]      |                                                                  |
| |           | B3/281 - -] [- - File #2 MAIN_PRGRM - 712                        |
|             |          -(U)- - File #2 MAIN_PRGRM - 713                        |
| |AUOFPULSE  |                                                                  |
| |  T4:283   |                                                                  |
| +---] [-----+                                                                  |
|      DN                                                                        |
|  [155]                                                                         |
Rung #712
|WATER FLOW                                                 WATER FLOW           |
|SWITCH TEST                                                SWITCH TIMER         |
|WFS_TST                                                    WFS_TMR              |
|     B3                                                    +--TON-----------+   |
|----] [----------------------------------------------------|TIMER ON DELAY  |-(EN)-|
|     281                                                   |TIMER:    T4:330|   |
|[711]                                                      |BASE (SEC):  1.0|-(DN)|
|                                                           |PRESET:       20|   |
|                                                           |ACCUM:         0|   |
|                                                           +----------------+   |
T4:330 - TON - File #2 MAIN_PRGRM -  712
         LEQ - File #2 MAIN_PRGRM -  719
T4:330.ACC - LEQ - File #2 MAIN_PRGRM -  717,718,720
             GEQ - File #2 MAIN_PRGRM -  717,718,719,720
T4:330.DN - -] [- - File #2 MAIN_PRGRM -  713
  ng #713
|                                                                  WATER FLOW    |
|                                                                  SWITCH TEST   |
|WFS_TMR                                                           WFS_TST       |
| T4:330                                                               B3        |
|---] [----------------------------------------------------------------(U)-------|
|    DN                                                               281        |
|[712]                                                                           |
B3/281 - -] [- - File #2 MAIN_PRGRM -  712
         -(L)- - File #2 MAIN_PRGRM -  711
         -(U)- - File #2 MAIN_PRGRM -  713
```

Rung #714

Description	Symbol	Address	Bit	Instruction
CATHODE WATER FLOW SWITCH 1	CHR1A	I:026	10	-|/|-
CATHODE WATER FLOW SWITCH 1	CHR1A	I:026	10	-|/|-
CATHODE WATER FLOW SWITCH 1	CHR1A	I:026	10	-|/|-
CATHODE WATER FLOW SWITCH 4	CHR4A	I:026	13	-|/|-
WATER FLOW SWITCH 5	CHR1B	I:026	14	-|/|-
CATHODE WATER FLOW SWITCH 6	CHR2B	I:026	15	-|/|-
CATHODE WATER FLOW SWITCH 7	CHR3B	I:026	16	-|/|-
CATHODE WATER FLOW SWITCH 8	CHR4B	I:026	17	-|/|-
CATHODE WATER FLOW SWITCH 9	WFS9	I:042	10	-|/|-
CATHODE WATER FLOW SWITCH 10	WFS10	I:042	11	-|/|-
CATHODE WATER FLOW SWITCH 11	WFS11	I:042	12	-|/|-
CATHODE WATER FLOW SWITCH 12	WFS12	I:042	13	-|/|-
FLOW SWITCH GROUP 1 OK	FTST1_OK	B3	283	-( )-

B3/283 - -| |- - File #2 MAIN_PRGRM - 717
-( )- - File #2 MAIN_PRGRM - 714

Rung #715

Description	Symbol	Address	Bit	Instruction
CATHODE WATER FLOW SWITCH 13	WFS13	I:042	14	-|/|-
CATHODE WATER FLOW SWITCH 14	WFS14	I:042	15	-|/|-
CATHODE WATER FLOW SWITCH 15	WFS15	I:042	16	-|/|-
CATHODE WATER FLOW SWITCH 16	WFS16	I:042	17	-|/|-
CATHODE WATER FLOW SWITCH 17	WFS17	I:056	10	-|/|-
CATHODE WATER FLOW SWITCH 18	WFS18	I:056	11	-|/|-
CATHODE WATER FLOW SWITCH 19	WFS19	I:056	12	-|/|-
CATHODE WATER FLOW SWITCH 20	WFS20	I:056	13	-|/|-
CATHODE WATER FLOW SWITCH 21	WFS21	I:056	14	-|/|-
CATHODE WATER FLOW SWITCH 22	WFS22	I:056	15	-|/|-
CATHODE WATER FLOW SWITCH 23	WFS23	I:056	16	-|/|-
CATHODE WATER FLOW SWITCH 24	WFS24	I:056	17	-|/|-
FLOW TEST GROUP 2 OK	FTST2_OK	B3	284	-( )-

B3/284 - -| |- - File #2 MAIN_PRGRM - 717
-( )- - File #2 MAIN_PRGRM - 715

Rung #716

Description	Symbol	Address	Bit	Instruction
CATHODE SHIELD H2O FLOW SWITCH 1	CSFS1	I:025	04	-|/|-
CATHODE SHIELD H2O FLOW SWITCH 2	CSFS2	I:025	05	-|/|-
CATHODE SHIELD H2O FLOW SWITCH 9	CSFS9	I:041	04	-|/|-
CATHODE SHIELD H2O FLOW SWITCH 10	CSFS10	I:041	05	-|/|-
CATHODE SHIELD H2O FLOW SWITCH 17	CSFS17	I:055	04	-|/|-
CATHODE SHIELD H2O FLOW SWITCH 18	CSFS18	I:055	05	-|/|-
HEATER SHIELD H2O FLOW SWITCH 1	HSFS1	I:006	10	-|/|-
HEATER SHIELD H2O FLOW SWITCH 2	HSFS2	I:006	11	-|/|-
HEATER SHIELD H2O FLOW SWITCH 3	HSFS3	I:006	12	-|/|-
HEATER SHIELD H2O FLOW SWITCH 4	HSFS4	I:006	13	-|/|-
HEATER SHIELD H2O FLOW SWITCH 5	HSFS5	I:023	16	-|/|-
HEATER SHIELD H2O FLOW SWITCH 6	HSFS6	I:023	17	-|/|-
FLOW TEST GROUP 3 OK	FTST3_OK	B3	285	-( )-

B3/285 - -| |- - File #2 MAIN_PRGRM - 717
-( )- - File #2 MAIN_PRGRM - 716

```
Rung #717
FLOW SWITCH      FLOW TEST       FLOW TEST                                                                 FLOW TEST CLOSE
GROUP 1 OK       GROUP 2 OK      GROUP 3 OK                                                                SUMMARY
FTST1_OK         FTST2_OK        FTST3_OK     WFS_TMR                        WFS_TMR                       FLOW_CL_TST
   B3               B3              B3        GEQ                            LEQ                               B3
---| |-------------| |-------------| |-------GRTR THAN OR EQUAL (A>=B)------LESS THAN OR EQUAL (A<=B)---------( )---
  283              284             285        SOURCE A:      T4:330.ACC      SOURCE A:      T4:330.ACC        286
[714]            [715]           [716]                                0                                0
                                              SOURCE B:               8      SOURCE B:                 9
                                                                      8                                9
                                              T4:330.ACC - [712]             T4:330.ACC - [712]

Rung #718
                                                                                                           WATER FLOW
                                                                                                           OPEN TEST
  HSFFTMR     WFS_TMR                           WFS_TMR                                                    WFS_OP_TST
   T4:93      GEQ                               LEQ                                                            B3
---| |-------GRTR THAN OR EQUAL (A>=B)---------LESS THAN OR EQUAL (A<=B)-----------------------------------( )---
     TT       SOURCE A:          T4:330.ACC     SOURCE A:          T4:330.ACC                                 339
  [5:199]                                 0                                 0
              SOURCE B:                  17     SOURCE B:                  18
                                         17                                18
              T4:330.ACC - [712]                T4:330.ACC - [712]
  CFFTMR
   T4:94
---| |---
     TT
  [5:202]

Rung #719
                                                                                                           OPEN WATER
                                 WATER FLOW                                                                VALVE FOR TEST
                                 SWITCH TIMER                                                              OP_VLV
WFS_TMR                          WFS_TMR                                                                       B3
GEQ                              LEQ
GRTR THAN OR EQUAL (A>=B)-------LESS THAN OR EQUAL (A<=B)-------------------------------------------------( )---
SOURCE A:          T4:330.ACC    SOURCE A:              T4:330                                                342
                            0                              512
SOURCE B:                  11    SOURCE B:                  19
                           11                               19
T4:330.ACC - [712]               T4:330 - [712]
B3/342 - -| |- - File #2 MAIN_PRGRM - 721
         -( )- - File #2 MAIN_PRGRM - 719

Rung #720
                                                                                                           CLOSE WATER
                                                                                                           VALVE FOR TEST
                                                                                                           CL_VLV
WFS_TMR                          WFS_TMR                                                                       B3
GEQ                              LEQ
GRTR THAN OR EQUAL (A>=B)-------LESS THAN OR EQUAL (A<=B)-------------------------------------------------( )---
SOURCE A:          T4:330.ACC    SOURCE A:          T4:330.ACC                                                341
                            0                                0
SOURCE B:                   1    SOURCE B:                   9
                            1                                9
T4:330.ACC - [712]               T4:330.ACC - [712]
B3/341 - -|/|- - File #2 MAIN_PRGRM - 721
         -( )- - File #2 MAIN_PRGRM - 720
```

Rung #721

RESET WATER VALVE RESET RSTH20PB I:024 16
WATER VALVE EMERGENCY OFF PUSHBUTTON H20EOFPB I:024 17
MAIN WATER ON MAIN_H20 I:002 07
CLOSE WATER VALVE FOR TEST CL_VLV B3 341 [720]
WATER VALVES H20_VLV B3 ( ) 146

WATER VALVES H20_VLV B3 146 [721]
OPEN WATER VALVE FOR TEST OP_VLV B3 342 [719]

B3/146 - ┤ ├ - File #2 MAIN_PRGRM - 721,723,728,731,734,737
-( )- - File #2 MAIN_PRGRM - 721

Rung #722

R_OF_DLY T4:322 DN [728]
CHROME WATER ON CHR_ON B3 (U) 273

B3/273 - ┤ ├ - File #2 MAIN_PRGRM - 724
-(L)- - File #2 MAIN_PRGRM - 723
-(U)- - File #2 MAIN_PRGRM - 722

Rung #723

WATER VALVES H20_VLV B3 146 [721]
MAIN WATER ON MAIN_H20 I:002 07
CHROME WATER ON CHR_ON B3 (L) 273
MAG WATER ON MAG_ON B3 (L) 274
CARBON WATER ON CAR_ON B3 (L) 275
HEATER WATER ON HTR_ON B3 (L) 276

B3/273 - ┤ ├ - File #2 MAIN_PRGRM - 724
-(U)- - File #2 MAIN_PRGRM - 722
B3/274 - ┤ ├ - File #2 MAIN_PRGRM - 730
-(U)- - File #2 MAIN_PRGRM - 729
B3/275 - ┤ ├ - File #2 MAIN_PRGRM - 733
-(U)- - File #2 MAIN_PRGRM - 732
B3/276 - ┤ ├ - File #2 MAIN_PRGRM - 736
-(U)- - File #2 MAIN_PRGRM - 735

460

Rung #724

```
|CHROME WATER                                                        CHROME RETURN |
|ON                                                                  VALVE 3       |
|CHR_ON        CHR_OF_DLY                                            CHRTV3        |
|    B3          T4:322                                                0:030       |
|----| |----------| |------------------------------------------------+---( )---+--|
|   273           DN                                               |     16    |  |
|[723]         [728]                                               |           |  |
| 0:030/16 - -| |- - File #2 MAIN_PRGRM - 725                       |CHROME RETURN |
| 0:030/17 - -| |- - File #2 MAIN_PRGRM - 725                       |VALVE 4    |  |
|                                                                  |CHRTV4     |  |
|                                                                  |   0:030   |  |
|                                                                  +---( )-----+  |
|                                                                        17       |
```

Rung #725

```
|CHROME SUPPLY  CHROME SUPPLY  CHROME RETURN  CHROME RETURN                        |
|VALVE 1        VALVE 2        VALVE 3        VALVE 4           CHROME WATER OK   |
|CHSUV1         CHSUV2         CHRTV3         CHRTV4            CHR-OK            |
|    0:030         0:030          0:030          0:030               B3          |
|-----| |-----------| |------------| |------------| |-----------------( )---------|
|      14            15             16             17                277         |
|[728]          [728]          [724]          [724]                               |
B3/277 - -| |- - File #2 MAIN_PRGRM -  235,236,238,242
         -|/|- - File #2 MAIN_PRGRM -  237,240,243
         -( )- - File #2 MAIN_PRGRM -  725
```

Pung #726

```
  ; SUPPLY     MAG SUPPLY   MAG RETURN   MAG RETURN                              |
|VALVE 5       VALVE 6      VALVE 7      VALVE 8                 MAG WATER OK     |
|MGSUV5        MGSUV6       MGRTV7       MGRTV8                  MAG_OK           |
|  0:044         0:044        0:044        0:044                     B3           |
|----| |-----------| |----------| |---------| |-----------------------( )---------|
|     14            15           16 -         17                     278          |
|[731]         [731]        [730]        [730]                                    |
B3/278 - -| |- - File #2 MAIN_PRGRM -  267,268,270,274
         -|/|- - File #2 MAIN_PRGRM -  269,272,275
         -( )- - File #2 MAIN_PRGRM -  726
```

Rung #727

```
|CARBON SUPPLY  CARBON SUPPLY  CARBON RETURN  CARBON RETURN                        |
|VALVE 9        VALVE 10       VALVE 11       VALVE 12          CARBON WATER OK   |
|CASUV9         CASUV10        CARTV11        CARTV12           CAR_OK            |
|    0:060         0:060          0:060          0:060               B3          |
|-----| |-----------| |------------| |------------| |-----------------( )---------|
|      14            15             16             17                279         |
|[734]          [734]          [733]          [733]                               |
B3/279 - -| |- - File #2 MAIN_PRGRM -  299,300
         -( )- - File #2 MAIN_PRGRM -  727
```

461

PCT/US 92/00722

Rung #728

```
CHROME CHAMBER =<250 MICRONS PIR6 I:024/07  ---| |---
WATER VALVES H2O_VLV B3/146                 ---| |---
CHR_ON_DLY T4:321 DN                         ---| |---
    CHROME SUPPLY VALVE 1 CHSUV1 O:030/14   ---( )---
    CHROME SUPPLY VALVE 2 CHSUV2 O:030/15   ---( )---

RESET WATER VALVE RESET RSTH20PB I:024/16   ---| |---   (parallel to I:024/07)

[721]
O:030/14 - -| |- - File #2 MAIN_PRGRM - 725
O:030/15 - -| |- - File #2 MAIN_PRGRM - 725
T4:321.DN - -| |- - File #2 MAIN_PRGRM - 728
T4:322.DN - -| |- - File #2 MAIN_PRGRM - 724
            -|/|- - File #2 MAIN_PRGRM - 722

[728]

CHROME WATER ON DELAY CHR_ON_DLY
+--TON-----------------+
|TIMER ON DELAY        |-(EN)-
|TIMER:        T4:321  |
|BASE (SEC):      1.0  |-(DN)
|PRESET:           10  |
|ACCUM:            10  |
+----------------------+

CHROME WATER OFF DELAY CHR_OF_DLY
+--TOF-----------------+
|TIMER OFF DELAY       |-(EN)-
|TIMER:        T4:322  |
|BASE (SEC):      1.0  |-(DN)
|PRESET:            2  |
|ACCUM:             0  |
+----------------------+
```

Rung #729

```
MAGNETIC WATER OFF DELAY MAG_OF_DLY T4:324 DN   ---|/|---
MAG WATER ON MAG_ON B3/274                      ---(U)---

[731]
B3/274 - -| |- - File #2 MAIN_PRGRM -  730
         -(L)- - File #2 MAIN_PRGRM -  723
         -(U)- - File #2 MAIN_PRGRM -  729
```

Rung #730

```
MAG WATER ON MAG_ON B3/274                      ---| |---
MAGNETIC WATER OFF DELAY MAG_OF_DLY T4:324 DN   ---| |---
    MAG RETURN VALVE 7 MGRTV7 O:044/16          ---( )---
    MAG RETURN VALVE 8 MGRTV8 O:044/17          ---( )---

[729]      [731]
O:044/16 - -| |- - File #2 MAIN_PRGRM - 726
O:044/17 - -| |- - File #2 MAIN_PRGRM - 726
```

```
Rung #731
| MAGNETIC
| CHAMBER
| =<250                                                                          MAG SUPPLY
| MICRONS     WATER VALVES                                                       VALVE 5
| PIR11       H20_VLV                                            MAG_ON_DLY      MGSUV5
|   I:040        B3                                               T4:323          O:044
|---] [----------] [------------------------------------------------] [----------( )----
|    07          146                                                 DN           14
|             [721]                                            [731]
|             O:044/14 - ] [ - File #2 MAIN_PRGRM - 726
|RESET WATER  O:044/15 - ] [ - File #2 MAIN_PRGRM - 726                         MAG SUPPLY
|VALVE RESET  T4:323.DN - ] [ - File #2 MAIN_PRGRM - 731                        VALVE 6
|RSTH20PB     T4:324.DN - ] [ - File #2 MAIN_PRGRM - 730                        MGSUV6
|   I:024                 ]/[ - File #2 MAIN_PRGRM - 729                         O:044
|---] [---                                                                     --( )--
|    16                                                                           15
|                                                               MAG WATER
|                                                               ON DELAY
|                                                               MAG_ON_DLY
|                                                               +--TON-----------+
|                                                               |TIMER ON DELAY  |-(EN)-
|                                                               |TIMER:    T4:323|
|                                                               |BASE (SEC):  1.0|-(DN)
|                                                               |PRESET:       10|
|                                                               |ACCUM:        10|
|                                                               +----------------+
|                                                               MAG WATER
|                                                               OFF DELAY
|                                                               MAG_OF_DLY
|                                                               +--TOF-----------+
|                                                               |TIMER OFF DELAY |-(EN)-
|                                                               |TIMER:    T4:324|
|                                                               |BASE (SEC):  1.0|-(DN)
|                                                               |PRESET:        2|
|                                                               |ACCUM:         0|
|                                                               +----------------+
Rung #732
|                                                                    CARBON WATER ON
|CAR_OF_DLY                                                          CAR_ON
|  T4:326                                                               B3
|---]/[-------------------------------------------------------------------(U)----
|    DN                                                                 275
|[734]
B3/275 - ] [ - File #2 MAIN_PRGRM - 733
         -(L)- - File #2 MAIN_PRGRM - 723
         -(U)- - File #2 MAIN_PRGRM - 732
Rung #733
|                                                                    CARBON RETURN
 RBON WATER ON                                                       VALVE 11
|CAR_ON         CAR_OF_DLY                                           CARTV11
|   B3            T4:326                                                O:060
|---] [-------------] [-------------------------------------------------( )----
|   275             DN                                                   16
|[732]          [734]
| O:060/16 - ] [ - File #2 MAIN_PRGRM - 727
| O:060/17 - ] [ - File #2 MAIN_PRGRM - 727                          CARBON RETURN
|                                                                    VALVE 12
|                                                                    CARTV12
|                                                                       O:060
|                                                                    ---( )---
|                                                                        17
```

```
Rung #734
| CARBON
| CHAMBER
| =<250                                                              CARBON SUPPLY
| MICRONS         WATER VALVES                                       VALVE 9
| PIR16           H20_VLV                           CAR_ON_DLY       CASUV9
|   I:054           B3                                T4:325           O:060
|---] [-------+-----] [---------------------------------+---] [----+----( )----+--
|     07      |    146                                  |    DN    |     14     |
|             |  [721]                                  | [734]    |            |
|             |  O:060/14 - ] [ - - File #2 MAIN_PRGRM - 727        |            |
|RESET WATER  |  O:060/15 - ] [ - - File #2 MAIN_PRGRM - 727        |CARBON SUPPLY
|VALVE RESET  |  T4:325.DN - ] [ - - File #2 MAIN_PRGRM - 734       |VALVE 10    |
|RSTH20PB     |  T4:326.DN - ] [ - - File #2 MAIN_PRGRM - 733       |CASUV10     |
|   I:024     |              ]/[ - - File #2 MAIN_PRGRM - 732       |   O:060    |
|---] [-------+                                         |          +----( )----+
      16                                                |                15
                                                        |CARBON WATER
                                                        |ON DELAY
                                                        |CAR_ON_DLY
                                                        +--TON-----------------+
                                                        |TIMER ON DELAY        |-(EN)-
                                                        |TIMER:       T4:325   |
                                                        |BASE (SEC):     1.0   |-(DN)
                                                        |PRESET:          10   |
                                                        |ACCUM:           10   |
                                                        +----------------------+
                                                        |CARBON WATER
                                                        |OFF DELAY
                                                        |CAR_OF_DLY
                                                        +--TOF-----------------+
                                                        |TIMER OFF DELAY       |-(EN)-
                                                        |TIMER:       T4:326   |
                                                        |BASE (SEC):     1.0   |-(DN)
                                                        |PRESET:           2   |
                                                        |ACCUM:            0   |
                                                        +----------------------+
Rung #735
|                                                                    HEATER WATER ON
|HTR_OF_DLY                                                          HTR_ON
|  T4:328                                                              B3
|---]/[--------------------------------------------------------------(U)----
|    DN                                                                276
|[737]
B3/276 - ] [ - - File #2 MAIN_PRGRM -  736
        -(L)- - File #2 MAIN_PRGRM -  723
        -(U)- - File #2 MAIN_PRGRM -  735
Rung #736
|                                                                    HEATER WATER
 ATER WATER ON                                                       VALVE 2
|HTR_ON          HTR_OF_DLY                                          HH202
|   B3             T4:328                                              O:010
|---] [--------------] [---------------------------------------------( )----
    276              DN                                                 17
|[735]           [737]
O:010/17 - ] [ - - File #2 MAIN_PRGRM -  147,148
          ]/[ - - File #2 MAIN_PRGRM -  149,150
         -( )- - File #2 MAIN_PRGRM -  736
```

```
Rung #737
| HEATER 1  CHROME                                                                     |
| CHAMBER   CHAMBER                                              HEATER WATER          |
| =<250     =<250                                               VALVE 1               |
| MICRONS   MICRONS    WATER VALVES                 HTR_ON_DLY  HH201                 |
| PIR2      PIR6       H20_VLV                         T4:327    O:010               |
|  I:004     I:024       B3                                                           |
+---] [-------] [----+----] [-------------------------+----] [-------( )-------+----|
| |  10        07    |   146                          |    DN        16        |    |
| |                  | [721]                          |[737]                   |    |
| |                  | O:010/16 - ] [ - File #2 MAIN_PRGRM - 147, 148           |    |
| |                  |          ]/[ - File #2 MAIN_PRGRM - 149, 150              |    |
| |RESET WATER       | T4:327.DN - ] [ - File #2 MAIN_PRGRM - 737               |    |
| |VALVE RESET       | T4:328.DN - ] [ - File #2 MAIN_PRGRM - 736               |    |
| |RSTH2OPB          |           ]/[ - File #2 MAIN_PRGRM - 735                 |    |
| |  I:024           |                              |HEATER WATER            |    |
| +---] [------------+                              |ON DELAY                |    |
|      16                                           |HTR_ON_DLY              |    |
|                                                   | +-TON---------------+  |    |
|                                                   +-|TIMER ON DELAY     |-(EN)-+ |
|                                                   | |TIMER:     T4:327  |       |
|                                                   | |BASE (SEC):   1.0  |-(DN)  |
|                                                   | |PRESET:        10  |       |
|                                                   | |ACCUM:         10  |       |
|                                                   | +-------------------+       |
|                                                   |HEATER WATER                 |
|                                                   |OFF DELAY                    |
|                                                   |HTR_OF_DLY                   |
|                                                   | +-TOF---------------+       |
|                                                   +-|TIMER OFF DELAY    |-(EN)--+
|                                                     |TIMER:     T4:328  |       |
|                                                     |BASE (SEC):   1.0  |-(DN)  |
|                                                     |PRESET:         2  |       |
|                                                     |ACCUM:          0  |       |
|                                                     +-------------------+       |

Rung #738
|                                                       JUMP TO CRYO               |
|                                                       REGEN                      |
|                                                       TO_CRGN                    |
|                                                       +-JSR-----------------+    |
+-------------------------------------------------------|JUMP TO SUBROUTINE   |----+
|                                                       |FILE #:          U:3 |    |
|                                                       |INPUT  PAR:          |    |
|                                                       |RETURN PAR:          |    |
|                                                       +---------------------+    |

Rung #739
|                                                       JUMP TO RETURN             |
|                                                       CONVEYOR SUBRTN            |
|                                                       JMP_TO_RTN                 |
|                                                       +-JSR-----------------+    |
+-------------------------------------------------------|JUMP TO SUBROUTINE   |----+
|                                                       |FILE #:          U:4 |    |
|                                                       |INPUT  PAR:          |    |
|                                                       |RETURN PAR:          |    |
|                                                       +---------------------+    |

Rung #740
|                                                       GOTO FAULT                 |
|                                                       RUNGS                      |
|                                                       TO__FLT                    |
|                                                       +-JSR-----------------+    |
+-------------------------------------------------------|JUMP TO SUBROUTINE   |----+
|                                                       |FILE #:          U:5 |    |
|                                                       |INPUT  PAR:          |    |
|                                                       |RETURN PAR:          |    |
|                                                       +---------------------+    |
```

```
Rung #741                                                    JUMP TO TECH
|                                                            RUNGS
|                                                            JMP_TR
|                                                            +-JSR----------------+
|------------------------------------------------------------+JUMP TO SUBROUTINE  +-|
|                                                            |FILE #:        U:6  |
|                                                            |INPUT  PAR:         |
|                                                            |RETURN PAR:         |
|                                                            +--------------------+
Rung #742
|------------------------------------------------------------------------[END]-|
```

```
Rung #000

 REGENERATE    ABORT CRYO                                                          COMPRESSOR
 CRYO 1        TIMER                                                               1 REGEN-
 TS01          ABORTCRYO                                                           ERATION
   N7:15         T4:297                                                            PROGRAM
 --] [----------]/[----------------------------------------------------------------CYRGN1
     9            TT                                                                 B3
 [2:3]         [27]                                                               --(L)--
                                                                                     321
               B3/321 - ] [ - File #2 MAIN_PRGRM - 115, 458
                              File #3 CRYO_REGEN - 1, 3, 4, 5, 21, 29, 30, 259    MANUAL
                              File #6 TECH_RUNGS - 14                             COMPRESSOR 1
                        ]/[ - File #2 MAIN_PRGRM - 26, 115                        REGENERATION
 REGENERATE                   File #3 CRYO_REGEN - 10, 12, 14, 17, 21, 23, 24, 33 ENABLE
 ALL CRYO'S             -(U)- - File #3 CRYO_REGEN - 25                           MC1RE
 TS20          N7:36/9 - -(U)- - File #3 CRYO_REGEN - 25                            N7:36
   N7:16       _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2                        --(L)--
 --] [--                                                                             9
     12
 [2:3]

Rung #001
 COMPRESSOR    HEATER 1
 1 REGEN-      CHAMBER
 ERATION       GATE VALVE                                              REGEN COMP. 1
 PROGRAM       CLOSE                                                   PULSE TIMER
 CYRGN1        HV1S1                                                   CR1PT
   B3            I:002                                                 +-TON---------------+
 --] [----------] [--------------------------------------------------+-|TIMER ON DELAY     |-(EN)-
   321           06                                                  | |TIMER:      T4:61 |
 [0]                                                                 | |BASE (SEC):   1.0 |-(DN)
                                                                     | |PRESET:         1 |
 T4:61.TT - ] [ - File #3 CRYO_REGEN - 5, 6, 7                       | |ACCUM:          0 |
 T4:341.ACC - LEQ - File #3 CRYO_REGEN - 3                           | +-------------------+
 T4:341.TT - ] [ - File #3 CRYO_REGEN - 2, 263                       |
             ]/[ - File #3 CRYO_REGEN - 264                          |
                                                                     |SIEVE TRAP
                                                                     |1 TIMER
                                                                     |S_TRAP_1
                                                                     | +-TON---------------+
                                                                     +-|TIMER ON DELAY     |-(EN)-
                                                                       |TIMER:     T4:341 |
                                                                       |BASE (SEC):   1.0 |-(DN)
                                                                       |PRESET:      5400 |
                                                                       |ACCUM:          0 |
                                                                       +-------------------+
```

```
Rung #002
|                                                                       |
|                MECHANICAL                                             |
|                PUMP 2                                 SIEVE TRAP     |
|                ISOLATION                              ISOLATION TRAP |
|                VALVE OPEN                             1              |
|  S_TRAP_1     MP2IVOP                                SVIV1          |
|   T4:341        I:025                                   O:010       |
|---] [-------+---] [-------------------------------------( )---------|
| |   TT      |    13                                      00         |
| |[1]        |                                                       |
| |           | O:010/00 - ] [ - File #3 CRYO_REGEN - 3               |
| |OPEN       |                                                       |
| |CRYO ROUGH |                                                       |
| |VALVE 1    |                                                       |
| |CR1        |                                                       |
| |  O:007    |                                                       |
| +---] [-----+                                                       |
|      11                                                             |
|  [15]
Rung #003
|COMPRESSOR                                                           |
|1 REGEN-                                                             |
|ERATION                     SIEVE TRAP                  SIEVE TRAP   |
|PROGRAM                     ISOLATION TRAP              1 HEATER     |
|CYRGN1    S_TRAP_1          1                           SVHTR1       |
|  B3      +-LEQ------------------+ SVIV1                 O:010       |
|--] [-----|LESS THAN OR EQUAL (A<=B)|---] [------------------( )-----|
|  321     |SOURCE A:    T4:341.ACC|   00                    12       |
|[0]       |                      0| [2]                              |
|          |SOURCE B:          3600|                                  |
|          |                   3600|                                  |
|          +-----------------------+                                  |
|           T4:341.ACC - [1]                                           |
Rung #004
|COMPRESSOR                                                           |
|1 REGEN-                                                SCREEN       |
|ERATION                                                 REGENERATION |
|PROGRAM                                                 CRYO 1       |
|CYRGN1                                                  SCRRGN1      |
|  B3                                                       B3        |
|--] [------------------------------------------------------( )-------|
|  321                                                      801       |
|[0]                                                                  |
Rung #005
|COMPRESSOR                                                           |
|1 REGEN-                                                             |
|ERATION     CRYO REGEN                                               |
|PROGRAM     1 PULSE                                     PURGE 1      |
 CYRGN1      CR1PT                                       P1           |
   B3         T4:61                                         B3        |
|---] [--------] [------------------------------------------(L)-------|
|   321         TT                                          631       |
|[0]          [1]                                                     |
B3/631 - ] [ - File #3 CRYO_REGEN - 7,9,11
               File #6 TECH_RUNGS - 15
         -(L)- - File #3 CRYO_REGEN - 5
         -(U)- - File #3 CRYO_REGEN - 12
```

```
Rung #006
                                                                                    ENABLE
                                                                                    CRYO
 CRYO REGEN                                                                         COMPRESSOR
 1 PULSE                                                                            1
 CR1PT                                                                              CY1
   T4:61                                                                              O:010
 ---] [---------------------------------------------------------------------------------(U)---
      TT                                                                               04
 [1]
                O:010/04 - -] [- - File #2 MAIN_PRGRM - 437
 MANUAL                            File #3 CRYO_REGEN - 260                        MANUAL CRYO
 CONTROL                           File #6 TECH_RUNGS - 19                         COMPRESSOR 1
 STOP CRYO                   -(L)- - File #2 MAIN_PRGRM - 26                       STOP
 COMPRESSOR     N7:29/5 - -(U)- - File #2 MAIN_PRGRM - 26                          MCYC1STOP
 1              _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2                          N7:29
 M-CY1-O        N7:34/5 - -(L)- - File #2 MAIN_PRGRM - 26                        ----(L)----
   N7:8         _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2                          5
 ---] [---
     5
 [2:3]                                                                             MANUAL CRYO
                                                                                   COMPRESSOR 1
                                                                                   RUN
                                                                                   MCYC1RUN
                                                                                     N7:34
                                                                                 ----(U)----
 MAIN WATER ON                                                                         5
 MAIN_H2O
   I:002
 ---]/[---
     07
Rung #007
                         OPEN
            CRYO REGEN   CRYO ROUGH                                           OPEN PURGE
 PURGE 1    1 PULSE      VALVE 1                                              VALVE 1
 P1         CR1PT        CR1                                                  NIF1
   B3         T4:61        O:007                                                O:007
 ---] [-------] [-----------]/[------------------------------------------------(L)---
   631         TT           11                                                   06
 [5]        [1]          [15]
O:007/06 - -] [- - File #3 CRYO_REGEN -  8
                   File #6 TECH_RUNGS -  16
             -(L)- - File #3 CRYO_REGEN -  7
             -(U)- - File #3 CRYO_REGEN -  10
Rung #008
                                                                              ENABLE
 OPEN PURGE                                                                   PURGE
 VALVE 1                                                                      HEATER 1
 NIF1                                                                         NIH1
   O:007                                                                        O:007
 ---] [-------------------------------------------------------------------------( )---
     06                                                                          03
 [7]
O:007/03 - -] [- - File #3 CRYO_REGEN -  9
           -( )- - File #3 CRYO_REGEN -  8
```

469

```
Rung #009
|                                                                    PURGE TIME          |
|          ENABLE     CYRO 1       PURGE                             MONITOR             |
|          PURGE      TEMPERATUR   TIMER                             COMPRESSOR 1        |
|PURGE 1   HEATER 1   =>290K       DEFEAT                            PGC1                |
|P1        NIH1       CY1TMP290    PG_DEFEAT                         +-TON------------+  |
|  B3        O:007      B3           B3                              |TIMER ON DELAY  |-(EN)-|
|--] [--------] [--------] [----------] [----------------------------|TIMER:     T4:21|  |
|  631        03        513          288                             |BASE (SEC):  1.0|-(DN)|
|[12]      [8]                                                       |PRESET:     7200|  |
|                                                                    |ACCUM:         0|  |
|                                                                    +----------------+  |
|
T4:21.ACC - GEQ - File #3 CRYO_REGEN - 30
T4:21.DN - ] [ - File #3 CRYO_REGEN - 10,11,262
T4:21.TT - ] [ - File #6 TECH_RUNGS - 15
Rung #010
|                PURGE TIME                                                              |
|                MONITOR                                                                 |
|  CYRO 1        CRYO 1                                                                  |
|  TEMPERATUR    60 MIN      BLOWER 2                                      OPEN PURGE    |
|  =>290K        DONE        ENABLED                                       VALVE 1       |
|  CY1TMP290     PGC1        BL2                                           NIF1          |
|     B3          T4:21       O:027                                           O:007      |
|-+--] [-----------] [---------] [--+---------------------------------------------(U)----|
| |    513          DN           01 |                                            06      |
| |              [9]          [2:74]|                                                    |
| |                                 | O:007/06 - ] [ - File #3 CRYO_REGEN - 8            |
| |                                 |                  File #6 TECH_RUNGS - 16           |
| |COMPRESSOR                       |          -(L)- - File #3 CRYO_REGEN - 7            |
| |1 REGEN-                         |                                                    |
| |ERATION                          |                                                    |
| |PROGRAM                          |                                                    |
| |CYRGN1                           |                                                    |
| |    B3                           |                                                    |
| +--]/[----------------------------+                                                    |
|    321                                                                                 |
| [0]
Rung #011
|            PURGE TIME                                                                  |
|            MONITOR                                                                     |
|            CRYO 1       CYRO 1                                                         |
|            60 MIN       TEMPERATUR   BLOWER 2                             ROUGHING      |
|PURGE 1     DONE         =>290K       ENABLED                              AND ROR 1     |
|P1          PGC1         CY1TMP290    BL2                                  R&ROR1        |
|  B3          T4:21        B3           O:027                                 B3        |
|--] [----------] [----------] [----------] [----------------------------------(L)-------|
|  631          DN          513          01                                   641        |
 [12]        [9]                      [2:74]
3/641 - ] [ - File #3 CRYO_REGEN - 12,15,16,17,18,19,20
              File #6 TECH_RUNGS - 17
        -(L)- - File #3 CRYO_REGEN - 11
        -(U)- - File #3 CRYO_REGEN - 21
```

```
Rung #012
| ROUGHING                                                              PURGE 1 |
| AND ROR 1                                                             P1      |
| R&ROR1                                                                   B3   |
|     B3                                                                        |
|-+---] [---+----------------------------------------------------------------(U)-|
| |   641   |                                                              631  |
| |[11]     |                                                                   |
| |         | B3/631 - -] [- - File #3 CRYO_REGEN - 7, 9, 11                    |
| |         |                  File #6 TECH_RUNGS - 15                          |
| |COMPRESSOR|         -(L)- - File #3 CRYO_REGEN - 5                           |
| |1 REGEN- |                                                                   |
| |ERATION  |                                                                   |
| |PROGRAM  |                                                                   |
| |CYRGN1   |                                                                   |
| |    B3   |                                                                   |
| +---]/[---+                                                                   |
|     321                                                                       |
|  [0]                                                                          |
Rung #013
|MANUAL                                                                         |
|CONTROL                                                                        |
|CRYO ROUGH                                                   MANUAL CRYO       |
|VALVE 1                                                      ROUGH 1           |
|OPEN                                                         OPEN              |
|-CR1-1                                                       MCR1OP            |
|  N7:12                                                         N7:33          |
|---] [-----------------------------------------------------+----(L)-----+------|
|     9                                                     |     9      |      |
|[2:3]                                                      |            |      |
| N7:33/9 - -] [- - File #3 CRYO_REGEN - 15                 |MANUAL CRYO |      |
|             -(U)- - File #3 CRYO_REGEN - 14               |ROUGH   1   |      |
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2               |CLOSE       |      |
| N7:28/9 - -(L)- - File #3 CRYO_REGEN - 14                 |MCR1CL      |      |
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2               |   N7:28    |      |
|                                                           +----(U)-----+      |
|                                                                 9             |
Rung #014
| MANUAL                                                                        |
| CONTROL                                                                       |
| CLOSE CRYO                                                  MANUAL CRYO       |
| ROUGH                                                       ROUGH 1           |
| VALVE 1                                                     OPEN              |
| M-CR1-O                                                     MCR1OP            |
|    N7:7                                                        N7:33          |
|-+---] [-----------------------+---------------------------+----(U)-----+------|
| |    9                        |                           |     9      |      |
| |[2:3]                        |                           |            |      |
| |                             | N7:33/9 - -] [- - File #3 CRYO_REGEN - 15     |
| |                             |           -(L)- - File #3 CRYO_REGEN - 13     |
| |COMPRESSOR                   | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2   |
| |1 REGEN-      CRYO 1         | N7:28/9 - -(U)- - File #3 CRYO_REGEN - 13     |
| |ERATION       TEMPERATUR     | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2   |
| |PROGRAM       =<20K          |                           |MANUAL CRYO |      |
| |CYRGN1        CY1TMP20       |                           |ROUGH   1   |      |
| |    B3           B3          |                           |CLOSE       |      |
| +---]/[---------] [-----------+                           |MCR1CL      |      |
|     321         501                                       |   N7:28    |      |
|  [25]                                                     +----(L)-----+      |
|                                                                 9             |
```

471

```
Rung #015
                                                           CRYO 1                                              OPEN
 ROUGHING   COMPRESSOR 1    LINE PRESSURE  BLOWER 2  THERMCOUPL                                          CRYO ROUGH
 AND ROR 1  ROR LATCH       MADE-TC10      ENABLED   50 MICRON                                           VALVE 1
 R&ROR1     CY1RORL         LPM-TC10       BL2       PIR3                                                CR1
    B3          B3              B3          O:027     I:004                                                O:007
 ---] [--------]/[-------+------] [----------] [--------]/[------------------------------------------+--------( )----
    641         601      |     250           01        11                                            |        11
 [11]       [16]         | [2:67]]      [2:74]                                                       |
                         | O:007/11 - ] [ - File #3 CRYO_REGEN - 2                                    |CRYO REGEN 1
                         |                  File #6 TECH_RUNGS - 14                                   |ROUGHING
 |MANUAL CRYO  CRYO 1    |             ]/[ - File #2 MAIN_PRGRM - 115, 387                             |TIMER
 |ROUGH 1      TEMPERATUR|                  File #3 CRYO_REGEN - 7                                    |CR1RUF_TMR
 |OPEN         =<20K     | T4:171.DN - ] [ - File #3 CRYO_REGEN - 31                                  |+-TON--------------+
 |MCR1OP       CY1TMP20  |                                                                             +|TIMER ON DELAY    |-(EN)-
 |   N7:33        B3     |                                                                              |TIMER:     T4:171 |
 +----] [--------]/[-----+                                                                              |BASE (SEC):   1.0 |-(DN)
      9          501                                                                                    |PRESET:       600 |
 [14]                                                                                                   |ACCUM:          0 |
                                                                                                        +------------------+
 |COOL DOWN
 |1
 |CD1
 |   B3
 +---] [-----------------+
    651
 [20]

Rung #016
           CRYO 1                    CRYO 1
 ROUGHING  THERMCOUPL  BLOWER 2  ROR LATCH                                                  COMPRESSOR 1
 AND ROR 1 50 MICRON   ENABLED   ONE SHOT                                                   ROR LATCH
 R&ROR1    PIR3        BL2       C1RORLOS                                                   CY1RORL
    B3       I:004      O:027       B3                                                         B3
 ---] [--------] [--------] [-------[ONS]---------------------------------------------------------(L)----
    641       11         01         551                                                        601
 [11]                  [2:74]
 B3/601 - ] [ - File #3 CRYO_REGEN -  18
                File #6 TECH_RUNGS -  17
         ]/[ -  File #3 CRYO_REGEN -  15
         -(L)- - File #3 CRYO_REGEN -  16
         -(U)- - File #3 CRYO_REGEN -  17

Rung #017
            ROR WAIT
            CRYO 1
 ROUGHING   60 SEC                                                                          COMPRESSOR 1
 AND ROR 1  DONE                                                                            ROR LATCH
 R&ROR1     C1RORTMR                                                                        CY1RORL
    B3        T4:31                                                                            B3
 +---] [--------] [-------+---------------------------------------------------------------------(U)----
    641         DN        |                                                                    601
 [21]        [18]         |
                          | B3/601 - ] [ - File #3 CRYO_REGEN - 18
                          |                File #6 TECH_RUNGS - 17
 |COMPRESSOR              |          ]/[ - File #3 CRYO_REGEN - 15
 |1 REGEN-                |          -(L)- - File #3 CRYO_REGEN - 16
 |ERATION                 |
 |PROGRAM                 |
 |CYRGN1                  |
 |     B3                 |
 +----]/[-----------------+
      321
 [25]
```

```
Rung #018
|                                                                     ROR WAIT            |
|ROUGHING   COMPRESSOR 1                                              COMPRESSOR 1        |
|AND ROR 1  ROR LATCH                                                 60 SEC              |
|R&ROR1     CY1RORL                                                   C1RORTMR            |
|   B3         B3                                                    +-TON-----------+    |
|---| |--------| |---------------------------------------------------+|TIMER ON DELAY |-(EN)-|
|   641        601                                                   |TIMER:    T4:31|    |
|[21]       [17]                                                     |BASE (SEC): 1.0|-(DN) |
|                                                                    |PRESET:      30|    |
|                                                                    |ACCUM:        0|    |
|                                                                    +---------------+    |
T4:31.DN - -| |- - File #3 CRYO_REGEN -  17,20
T4:31.TT - -| |- - File #6 TECH_RUNGS -  18
Rung #019
|                                                                     REROUGH             |
|           CRYO 1                                                    COUNTER             |
|ROUGHING   THERMCOUPL                                                COMPRESSOR          |
|AND ROR 1  50 MICRON                                                 1                   |
|R&ROR1     PIR3                                                      C1RERUF             |
|   B3       I:004                                                   +-CTU-----------+    |
|---| |--------|/|---------------------------------------------------+|COUNT UP       |-(CU)-|
|   641        11                                                    |COUNTER:   C5:1|    |
|[21]                                                                |PRESET:      20|-(DN) |
|                                                                    |ACCUM:        0|    |
|                                                                    +---------------+    |
  .1 - CTU - File #3 CRYO_REGEN -  19
       RES - File #3 CRYO_REGEN -  23
C5:1.DN - -| |- - File #2 MAIN_PRGRM -  623
Rung #020
|                     ROR WAIT                                                            |
|           CRYO 1     CRYO 1    CRYO 1                                                   |
|ROUGHING   THERMCOUPL 60 SEC    TEMPERATUR                                   COOL DOWN   |
|AND ROR 1  50 MICRON  DONE      =<20K                                        1           |
|R&ROR1     PIR3       C1RORTMR  CY1TMP20                                     CD1         |
|   B3       I:004      T4:31     B3                                             B3       |
|---| |--------| |--------| |-------|/|------------------------------------------(L)------|
|   641        11         DN        501                                          651      |
|[21]                  [18]                                                               |
B3/651 - -| |- - File #2 MAIN_PRGRM -  26,115
                 File #3 CRYO_REGEN -  15,21,22,25
                 File #6 TECH_RUNGS -  19
        -(L)- - File #3 CRYO_REGEN -  20
        -(U)- - File #3 CRYO_REGEN -  24
```

```
Rung #021
| COMPRESSOR
| 1 REGEN-
| ERATION                    COOL DOWN                                                          ROUGHING
| PROGRAM                    1                                                                  AND ROR 1
| CYRGN1          PDM1       CD1                                                                R&ROR1
|    B3          T4:41       B3                                                                    B3
|---] [---------] [---------] [-----+-------------------------------------------------------------(U)---|
| |  321           TT         651   |                                                               641
| |[25]           [22]       [20]   |
| |                                 | B3/641 - ] [ - File #3 CRYO_REGEN - 12, 15, 16, 17, 18, 19, 20
| |                                 |                File #6 TECH_RUNGS - 17
| |COMPRESSOR                       |          -(L)- - File #3 CRYO_REGEN - 11
| |1 REGEN-                         |
| |ERATION                          |
| |PROGRAM                          |
| |CYRGN1                           |
| |   B3                            |
| +---]/[---------------------------+
|    321
|  [25]
Rung #022
|               CRYO 1                                                              REGEN
|COOL DOWN      TEMPERATUR                                                          TIME TO
|1              =<20K                                                               20K 1
|CD1            CY1TMP20                                                            PDM1
|    B3            B3                                                               +-TON-------------+
|---] [-----------]/[---------------------------------------------------------------|TIMER ON DELAY   |-(EN)-
|   651           501                                                               |TIMER:     T4:41|
|[20]                                                                               |BASE (SEC):  1.0|-(DN)
|                                                                                   |PRESET:     7200|
|                                                                                   |ACCUM:         0|
|                                                                                   +-----------------+
T4:41.DN - ] [ - File #3 CRYO_REGEN - 30,32
T4:41.TT - ] [ - File #3 CRYO_REGEN - 21
```

```
, [25]
C5:1 - CTU - File #3 CRYO_REGEN - 19
       RES - File #3 CRYO_REGEN - 23
C5:1.DN - ] [ - File #2 MAIN_PRGRM - 623
Rung #024
|COMPRESSOR
|1 REGEN-
|ERATION                                                                                  COOL DOWN
|PROGRAM                                                                                  1
|CYRGN1                                                                                   CD1
|   B3                                                                                       B3
|---]/[------------------------------------------------------------------------------------(U)---|
|  321                                                                                       651
|[25]
B3/651 - ] [ - File #2 MAIN_PRGRM - 26,115
               File #3 CRYO_REGEN - 15,21,22,25
               File #6 TECH_RUNGS - 19
        -(L)- - File #3 CRYO_REGEN - 20
```

```
BASE :   Rung #023
| COMPRESSOR   CRYO 1                                                                      REROUGH     |
| 1 REGEN-     COUNTER                                                                     COUNTER     |
| ERATION      RESET                                                                       COMPRESSOR  |
| PROGRAM      ONE SHOT                                                                    1           |
| CYRGN1       C1CROS                                                                      C1RERUF     |
|       B3           B3                                                                       C5:1     |
|-+----]/[--------[ONS]-+------------------------------------------------------------------[RES]------|
| |     321         561 |                                                                              |
| |[25]                 |                                                                              |
| |                     | C5:1 - CTU - File #3 CRYO_REGEN - 19                                         |
| |                     | C5:1.DN - ] [ - File #2 MAIN_PRGRM - 624                                     |
| |PAUSE                |                                                                              |
| |DISABLE              |                                                                              |
| |TS12                 |                                                                              |
| |  N7:16              |                                                                              |
| +----] [--------------+                                                                              |
|       4                                                                                              |
|  [2:3]                                                                                               |
```

475

```
 -(U)- - File #3 CRYO_REGEN -  24
Rung #025
|                                                                                 COMPRESSOR  |
|                CRYO 1                                                           1 REGEN-    |
| COOL DOWN      TEMPERATUR                                                       ERATION     |
| 1              =<20K                                                            PROGRAM     |
| CD1            CY1TMP20                                                         CYRGN1      |
|     B3            B3                                                                B3      |
|----| |-----------| |------+-----------------------------------------------------+---(U)---+-|
| |   651          501      |                                                   |   321    | |
| |[24]                     |                                                   |          | |
| |                         | B3/321 - -| |- - File #2 MAIN_PRGRM - 115, 458     |MANUAL    | |
| |                         |           File #3 CRYO_REGEN - 1, 3, 4, 5, 21, 29, 30, 259   |COMPRESSOR 1 | |
| |                         |           File #6 TECH_RUNGS - 14                 |REGENERATION | |
| |                         |      -|/|- - File #2 MAIN_PRGRM - 26, 115         |ENABLE    | |
| | REGENERATE   ABORT CRYO |           File #3 CRYO_REGEN - 10, 12, 14, 17, 21, 23, 24, 33 |MC1RE | |
| | CRYO 1       TIMER      |      -(L)- - File #3 CRYO_REGEN - 0               |   N7:36  | |
| | TS01         ABORTCRYO  | N7:36/9 - -(L)- - File #3 CRYO_REGEN - 0          +---(U)----+ |
| |    N7:15        T4:297  | _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2           9        |
| +----| |-----+-----| |----+                                                                |
| | |    9     |     TT     |                                                                |
| | |[2:3]     |  [27]      |                                                                |
| | |REGENERATE|            |                                                                |
| | |ALL CRYO'S|            |                                                                |
| | |TS20      |            |                                                                |
| | |   N7:16  |            |                                                                |
| | +----| |---+            |                                                                |
| |      12                 |                                                                |
| | [2:3]                   |                                                                |
| |PIRANI                   |                                                                |
| |GUAGE 2                  |                                                                |
| |NO FAULT                 |                                                                |
| |PGNF2                    |                                                                |
| |  I:004                  |                                                                |
| +---|/|-------------------+                                                                |
| |   15                    |                                                                |
| |CRYO RE-                 |                                                                |
| |GENERATION               |                                                                |
| |FAULT                    |                                                                |
| |COMPRESSOR               |                                                                |
| |1                        |                                                                |
| |CRFLT1                   |                                                                |
| |    B3                   |                                                                |
| +---| |-------------------+                                                                |
| |   331                   |                                                                |
| |[30]                     |                                                                |
| |PREPARE FOR              |                                                                |
| |AUTO RUN                 |                                                                |
| |>AUTO                    |                                                                |
| |   N7:37                 |                                                                |
| +----| |------------------+                                                                |
|       1                                                                                    |
| [2:157]
Rung #026
|ABORT CRYO                                                                    ABORT CRYO    |
|REGENERATION                                                                  REGEN ENABLE  |
|BT_CR                                                                         ABORTCRGN     |
|   N7:17                                                                           B3       |
|----| |-----------------------------------------------------------------------------(L)------|
|     9                                                                             297      |
|[2:3]                                                                                       |
B3/297 - -| |- - File #2 MAIN_PRGRM -  21
```

```
                    File #3 CRYO_REGEN -  27
          -(L)- - File #3 CRYO_REGEN -  26
          -(U)- - File #3 CRYO_REGEN -  28
Rung #027
|ABORT CRYO                                                              ABORT CRYO          |
|REGEN ENABLE                                                            REGEN TIMER         |
|ABORTCRGN                                                               ABORTCRYO           |
|      B3                                                                +-TON-----------+   |
|-----] [----------------------------------------------------------------|TIMER ON DELAY |-(EN)-|
|      297                                                               |TIMER:  T4:297 |   |
|[26]                                                                    |BASE (SEC): 1.0|-(DN)|
|                                                                        |PRESET:      10|   |
|                                                                        |ACCUM:        0|   |
|                                                                        +---------------+   |
|
T4:297.DN - ] [ - File #3 CRYO_REGEN -  28
T4:297.TT - ] [ - File #2 MAIN_PRGRM -  91
                  File #3 CRYO_REGEN -  25,238,239,240,241,242,243,244
              ]/[ - File #3 CRYO_REGEN -  0,34,38,42,46,52,53,57,63
Rung #028
|                                                                              ABORT CRYO    |
|                                                                              REGEN ENABLE  |
|ABORTCRYO                                                                     ABORTCRGN     |
|  T4:297                                                                          B3        |
|-----] [-------------------------------------------------------------------------(U)-------|
|      DN                                                                          297       |
|[27]
 /297 - ] [ - File #2 MAIN_PRGRM -  21
              File #3 CRYO_REGEN -  27
       -(L)- - File #3 CRYO_REGEN -  26
       -(U)- - File #3 CRYO_REGEN -  28
Rung #029
|COMPRESSOR  HEATER 1                                                                        |
|1 REGEN-    CHAMBER                                                     CRYO REGEN          |
|ERATION     GATE VALVE                                                  COMPRESSOR 1        |
|PROGRAM     CLOSE                                                       HV1 FAULT           |
|CYRGN1      HV1S1                                                       CR1FLT              |
|    B3        I:002                                                     +-TON-----------+   |
|-----] [--------]/[-----------------------------------------------------|TIMER ON DELAY |-(EN)-|
|    321        06                                                       |TIMER:   T4:11 |   |
|[25]                                                                    |BASE (SEC): 1.0|-(DN)|
|                                                                        |PRESET:      30|   |
|                                                                        |ACCUM:        0|   |
|                                                                        +---------------+   |
|
T4:11.DN - ] [ - File #3 CRYO_REGEN -  30
```

Rung #030

```
|                 COOL DOWN                                                          CRYO RE-    |
|COMPRESSOR       AFTER CRYO                                                         GENERATION  |
|1 REGEN-         REGEN                                                              FAULT       |
|ERATION          CRYO 1                                                             COMPRESSOR  |
|PROGRAM          2 HOUR                                                             1           |
|CYRGM1           PCM1                                                               CRFLT1      |
|   B3               T4:41                                                              B3       |
|---] [---------+----] [--------------------------+-------------------------------------( )------|
|   321         |       DN                        |                                    331       |
|[25]           |[22]                             |                                              |
|               |                                 | B3/331 - ] [ - - File #3 CRYO_REGEN - 25      |
|               |                                 |                  File #6 TECH_RUNGS - 16      |
|               |HIVAC 1                          |                                              |
|               |10 SEC                           |                                              |
|               |TIMER                            |                                              |
|               |COMPLETE                         |                                              |
|               |CR1FLT                           |                                              |
|               |  T4:11                          |                                              |
|               +---] [---------------------------+                                              |
|               |    DN                           |                                              |
|               |[29]                             |                                              |
|               |PURGE TIMER                      |                                              |
|               |MONITOR                          |                                              |
|               |CRYO 1                N2 FLOW SWITCH                                            |
|               |5SEC TEST             1          |                                              |
|               |PGC1                             |                                              |
|               | +-GEQ-------------------+  I:002 |                                              |
|               +-+GRTR THAN OR EQUAL (A>=B)+---]/[--+                                             |
|               | |SOURCE A:      T4:21.ACC|   00  |                                              |
|               | |                       0|      |                                              |
|               | |SOURCE B:              5|      |                                              |
|               | |                       5|      |                                              |
|               | +------------------------+      |                                              |
|               |T4:21.ACC - [9]                  |                                              |
|               |PIRANI                           |                                              |
|               |GUAGE 2                          |                                              |
|               |NO FAULT                         |                                              |
|               |PGNF2                            |                                              |
|               |  I:004                          |                                              |
|               +---]/[---------------------------+                                              |
|                   15                                                                           |
```

Rung #031

```
|                     REPURGE                                                          |
|                     COMPRESSOR                                          CRYO REGEN   |
|                     1 TIMER                                             ROUGHING     |
|NO CRYOS BEING      DONE                                                TIMEOUT      |
|REGENERATED         5 MINUTE                                            CR_RUFF_TIME |
|NO_CYRGN            CR1RUF_TMR                                              83       |
|      83              T4:171                                                         |
|-----]/[-----------+----] [----+------------------------------------------( )--------|
|      233          |     DN    |                                            818      |
|[33]               |[15]       |                                                     |
|                   |           | 83/818 - ] [ - File #2 MAIN_PRGRM - 624             |
|                   |EXCESS     |                                                     |
|                   |ROUGHING   |                                                     |
|                   |TIME       |                                                     |
|                   |CRYOPUMP 2 |                                                     |
|                   |CR2RUF_TMR |                                                     |
|                   |  T4:172   |                                                     |
|                   |----] [----|                                                     |
|                   |     DN    |                                                     |
|                   |[164]      |                                                     |
|                   |REPURGE    |                                                     |
|                   |COMPRESSOR |                                                     |
|                   |3 TIMER    |                                                     |
|                   |DONE       |                                                     |
|                   |5 MINUTE   |                                                     |
|                   |CR3RUF_TMR |                                                     |
|                   |  T4:173   |                                                     |
|                   |----] [----|                                                     |
|                   |     DN    |                                                     |
|                   |[165]      |                                                     |
|                   |REPURGE    |                                                     |
|                   |COMPRESSOR |                                                     |
|                   |4 TIMER    |                                                     |
|                   |DONE       |                                                     |
|                   |5 MINUTE   |                                                     |
|                   |CR4RUF_TMR |                                                     |
|                   |  T4:174   |                                                     |
|                   |----] [----|                                                     |
|                   |     DN    |                                                     |
|                   |[167]      |                                                     |
|                   |REPURGE    |                                                     |
|                   |COMPRESSOR |                                                     |
|                   |5 TIMER    |                                                     |
|                   |DONE       |                                                     |
|                   |5 MINUTE   |                                                     |
|                   |CR5RUF_TMR |                                                     |
|                   |  T4:175   |                                                     |
|                   |----] [----|                                                     |
|                   |     DN    |                                                     |
|                   |[166]      |                                                     |
|                   |REPURGE    |                                                     |
|                   |COMPRESSOR |                                                     |
|                   |6 TIMER    |                                                     |
|                   |DONE       |                                                     |
|                   |5 MINUTE   |                                                     |
|                   |CR6RUF_TMR |                                                     |
|                   |  T4:176   |                                                     |
|                   |----] [----|                                                     |
|                   |     DN    |                                                     |
|                   |[168]      |                                                     |
|                   |REPURGE    |                                                     |
|                   |COMPRESSOR |                                                     |
>                   >           >                                                     >
```

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```
<                   <           <                                                         <
|                   |7 TIMER    |                                                         |
|                   |DONE       |                                                         |
|                   |5 MINUTE   |                                                         |
|                   |CR7RUF_TMR |                                                         |
|                   |   T4:177  |                                                         |
|                   |----] [----|                                                         |
|                   |     DN    |                                                         |
|                   |[169]      |                                                         |
|                   |CR8RUF_TMR |                                                         |
|                   |   T4:178  |                                                         |
|                   |----] [----|                                                         |
|                   |     DN    |                                                         |
|                   |[170]      |                                                         |
|                   |CR9RUF_TMR |                                                         |
|                   |   T4:179  |                                                         |
|                   |----] [----|                                                         |
|                   |     DN    |                                                         |
|                   |[171]      |                                                         |
|                   |CR10RUF_TMR|                                                         |
|                   |   T4:180  |                                                         |
|                   |-----] [---|                                                         |
|                   |      DN   |                                                         |
|                   |[172]      |                                                         |
|                   |CR11RUF_TMR|                                                         |
|                   |   T4:181  |                                                         |
|                   |-----] [---|                                                         |
|                   |      DN   |                                                         |
|                   |[174]      |                                                         |
```

Rung #032

```
|                   COOL DOWN                                                   |
|                   AFTER CRYO                                      CRYO REGEN  |
|                   REGEN                                           COOL DOWN   |
|NO CRYOS BEING     CRYO 1                                          >2 HOURS    |
|REGENERATED        2 HOUR                                          CR_CD>2H    |
|NO_CYRGN           PDM1                                               B3       |
|      B3            T4:41                                                      |
|-----]/[-----+-------] [-------+--------------------------------------( )------|
|      233    |         DN      |                                      820      |
|[33]         |[22]             |                                               |
|             |                 | B3/820 - ] [ - File #2 MAIN_PRGRM - 624       |
|             |COOL DOWN        |                                               |
|             |AFTER CRYO       |                                               |
|             |REGEN            |                                               |
|             |CRYO 2           |                                               |
|             |2 HOUR           |                                               |
|             |PDM2             |                                               |
|             |    T4:42        |                                               |
|             +-------] [-------+                                               |
|             |        DN       |                                               |
|             |[217]            |                                               |
|             |PUMPDOWN         |                                               |
|             |AFTER CRYO       |                                               |
|             |REGEN            |                                               |
|             |COMPRESSOR       |                                               |
|             |3  2 HOUR        |                                               |
|             |PDM3             |                                               |
|             |    T4:43        |                                               |
|             +-------] [-------+                                               |
|             |        DN       |                                               |
|             |[218]            |                                               |
|             |PUMPDOWN         |                                               |
|             |AFTER CRYO       |                                               |
|             |REGEN            |                                               |
|             |COMPRESSOR       |                                               |
|             |4  2 HOUR        |                                               |
|             |PDM4             |                                               |
|             |    T4:44        |                                               |
|             +-------] [-------+                                               |
|             |        DN       |                                               |
|             |[219]            |                                               |
|             |PUMPDOWN         |                                               |
|             |AFTER CRYO       |                                               |
|             |REGEN            |                                               |
|             |COMPRESSOR       |                                               |
|             |5  2 HOUR        |                                               |
|             |PDM5             |                                               |
|             |    T4:45        |                                               |
|             +-------] [-------+                                               |
|             |        DN       |                                               |
|             |[220]            |                                               |
|             |PUMPDOWN         |                                               |
|             |AFTER CRYO       |                                               |
|             |REGEN            |                                               |
|             |COMPRESSOR       |                                               |
|             |6  2 HOUR        |                                               |
|             |PDM6             |                                               |
|             |    T4:46        |                                               |
|             +-------] [-------+                                               |
|             |        DN       |                                               |
|             |[221]            |                                               |
|             |PUMPDOWN         |                                               |
>             >                 >                                               >
```

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```
|               |AFTER CRYO |
|               |REGEN      |
|               |COMPRESSOR |
|               |7  2 HOUR  |
|               |PDM7       |
|               |   T4:47   |
|               |----] [----|
|               |    DN     |
|               |[222]      |
|               |PUMPDOWN   |
|               |AFTER CRYO |
|               |REGEN      |
|               |COMPRESSOR |
|               |8  2 HOUR  |
|               |PDM8       |
|               |   T4:48   |
|               +----] [----+
|                   DN
|               [223]
```

Rung #033

```
|COMPRESSOR COMPRESSOR COMPRESSOR COMPRESSOR COMPRESSOR COMPRESSOR COMPRESSOR COMPRESSOR                 |
|1 REGEN-   2 REGEN-   3 REGEN-   4 REGEN-   5 REGEN-   6 REGEN-   7 REGEN-   8 REGEN-                   |
|ERATION    ERATION    ERATION    ERATION    ERATION    ERATION    ERATION    ERATION       NO CRYOS BEING|
|PROGRAM    PROGRAM    PROGRAM    PROGRAM    PROGRAM    PROGRAM    PROGRAM    PROGRAM       REGENERATED   |
|CYRGN1     CYRGN2     CYRGN3     CYRGN4     CYRGN5     CYRGN6     CYRGN7     CYRGN8        NO_CYRGN      |
|   B3        B3         B3         B3         B3         B3         B3         B3               B3      |
|---]/[-------]/[--------]/[--------]/[--------]/[--------]/[--------]/[--------]/[-------------( )------|
|  321       322        323        324        325        326        327        328              233      |
|[25]      [34]       [38]       [42]       [46]       [52]       [57]       [63]                        |
B3/233 - ] [ - File #2 MAIN_PRGRM - 23,91
         ]/[ - File #2 MAIN_PRGRM - 91
               File #3 CRYO_REGEN - 31,32
         -( )- - File #3 CRYO_REGEN - 33
```

Rung #034

```
|                                                                               COMPRESSOR     |
|                                                                               2 REGEN-       |
| REGENERATE                  ABORT CRYO                                        ERATION        |
| CRYO 2                      TIMER                                             PROGRAM        |
| TS02                        ABORTCRYO                                         CYRGN2         |
|   N7:15                        T4:297                                            B3          |
|+----] [----------------+------]/[---------------------------------------------+---(L)------+-|
|| |   10                |         TT                                           |   322      | |
|| |[2:3]                |[27]                                                  |            | |
|| |                     |                                                      |MANUAL      | |
|| |                     |B3/322 - ] [ - File #2 MAIN_PRGRM - 110, 117, 118, 460, 462         |COMPRESSOR 2| |
|| |                     |               File #3 CRYO_REGEN - 35, 37, 67, 74, 210, 245, 252,  |REGENERATION| |
|| |                     |               259                                    |ENABLE      | |
|  |                     |               File #6 TECH_RUNGS - 14                |MC2RE       | |
|  |                     |         ]/[ - File #2 MAIN_PRGRM - 27, 117, 118      |   N7:36    | |
|  |HI_STAG              |               File #3 CRYO_REGEN - 33, 117, 135, 143, 176, 210, 224,+---(L)------+ |
|  |+-GEQ---------------+|               231                                        10         |
|  +|GRTR THAN OR EQUAL (A>=B)|-+       -(U)- - File #3 CRYO_REGEN - 238                        |
|   |SOURCE A:    T4:197.ACC|   N7:36/10 - -(U)- - File #3 CRYO_REGEN - 238                   |
|   |                      0|   _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2                     |
|   |SOURCE B:             5|                                                                 |
|   |                      5|                                                                 |
|   +-----------------------+                                                                 |
|  T4:197.ACC - [2:20]                                                                        |
```

Rung #035

COMPRESSOR 2 REGEN-ERATION PROGRAM CYRGN2
B3
322
[34]

HEATER 2 CHAMBER GATE VALVE CLOSE HV2S1
I:004
00

REGEN COMP. 2 PULSE TIMER CR2PT
TON
TIMER ON DELAY (EN)
TIMER: T4:62
BASE (SEC): 1.0 (DN)
PRESET: 1
ACCUM: 0

T4:62.TT - ┤ ├ - File #3 CRYO_REGEN - 74, 81, 88
T4:342.ACC - LEQ - File #3 CRYO_REGEN - 37
T4:342.TT - ┤ ├ - File #3 CRYO_REGEN - 36, 263
┤/├ - File #3 CRYO_REGEN - 264

SIEVE TRAP 2 TIMER S_TRAP_2
TON
TIMER ON DELAY (EN)
TIMER: T4:342
BASE (SEC): 1.0 (DN)
PRESET: 5400
ACCUM: 0

Rung #036

S_TRAP_2
T4:342
TT
[35]

MECHANICAL PUMP 2 ISOLATION VALVE OPEN MP2IVOP
I:025
13

SIEVE TRAP ISOLATION VALVE 2 SVIV2
O:010
( )
01

O:010/01 - ┤ ├ - File #3 CRYO_REGEN - 37

OPEN CRYO ROUGH VALVE 2 CR2
O:007
12
[164]

Rung #037

COMPRESSOR 2 REGEN-ERATION PROGRAM CYRGN2
B3
322
[34]

S_TRAP_2
LEQ
LESS THAN OR EQUAL (A<=B)
SOURCE A: T4:342.ACC
0
SOURCE B: 3600
3600

T4:342.ACC - [35]

SIEVE TRAP ISOLATION VALVE 2 SVIV2
O:010
01
[36]

SIEVE TRAP HEATER 2 SVHTR2
O:010
( )
14

Rung #038

```
                                                                             COMPRESSOR
                                                                             3 REGEN-
 REGENERATE           ABORT CRYO                                             ERATION
 CRYO 3               TIMER                                                  PROGRAM
 TS03                 ABORTCRYO                                              CYRGN3
   N7:15                T4:297                                                 B3
---| |-----------------]/[-----------------------------------------------------(L)---
    11                    TT                                                   323
 [2:3]                [27]
                                                                             MANUAL
                      B3/323 - ] [ - File #2 MAIN_PRGRM - 111, 119, 120, 464, 466     COMPRESSOR 3
                                     File #3 CRYO_REGEN - 39, 41, 68, 75, 211, 246, 253,  REGENERATION
                                     259                                     ENABLE
                                     File #6 TECH_RUNGS - 14                 MC3RE
                               ]/[ - File #2 MAIN_PRGRM - 28, 119, 120         N7:36
 HI_STAG                             File #3 CRYO_REGEN - 33, 118, 136, 145, 178, 211, 225, ---(L)---
  GEQ                                232                                        11
 GRTR THAN OR EQUAL (A>=B)     -(U)- - File #3 CRYO_REGEN - 239
 SOURCE A:       T4:197.ACC   N7:36/11 - -(U)- - File #3 CRYO_REGEN - 239
                          0   _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2
 SOURCE B:               10
                         10

 T4:197.ACC - [2:20]
```

Rung #039

```
 MPRESSOR  DWELL 1
 REGEN-    CHAMBER
 ERATION   GATE VALVE                                          REGEN COMP. 3
 PROGRAM   CLOSED                                              PULSE TIMER
 CYRGN3    HV3S1                                               CR3PT
   B3      I:004                                                TON
---| |-------| |-----------------------------------------------+-TIMER ON DELAY    -(EN)-
   323       03                                                 TIMER:      T4:63
 [38]                                                           BASE (SEC):   1.0 -(DN)
                                                                PRESET:         1
 T4:63.TT - ] [ - File #3 CRYO_REGEN - 75, 82, 89               ACCUM:          0
 T4:343.ACC - LEQ - File #3 CRYO_REGEN - 41
 T4:343.TT - ] [ - File #3 CRYO_REGEN - 40, 263
             ]/[ - File #3 CRYO_REGEN - 264
                                                               SIEVE TRAP
                                                               3 TIMER
                                                               S_TRAP_3
                                                                TON
                                                               +-TIMER ON DELAY   -(EN)-
                                                                TIMER:     T4:343
                                                                BASE (SEC):   1.0 -(DN)
                                                                PRESET:      5400
                                                                ACCUM:          0
```

```
Rung #040
|                                                                        |
|               MECHANICAL                                  SIEVE TRAP   |
|               PUMP 2                                      ISOLATION VALVE
|               ISOLATION                                   3            |
|               VALVE OPEN                                  SVIV3        |
|   S_TRAP_3    MP2IVOP                                           O:011  |
|    T4:343      I:025                                                   |
|----] [-----+----] [-------------------------------------------( )------|
| |    TT    |     13                                              17    |
| |[39]      |                                                           |
| |          | O:011/17 - ] [ - File #3 CRYO_REGEN - 41                  |
| |OPEN      |                                                           |
| |CRYO ROUGH|                                                           |
| |VALVE 3   |                                                           |
| |CR3       |                                                           |
| |  O:007   |                                                           |
| +---] [----+                                                           |
|      13                                                                |
| [165]
Rung #041
|COMPRESSOR                                                              |
|3 REGEN-                 SIEVE TRAP                                     |
|ERATION                  ISOLATION VALVE                   SIEVE TRAP   |
|PROGRAM                  3                                 HEATER 3     |
|CYRGN3     S_TRAP_3      SVIV3                             SVHTR3       |
|   B3     +-LEQ----------------------+  O:011                 O:010     |
|---] [----|LESS THAN OR EQUAL (A<=B) |---] [----------------------( )---|
|   323    |SOURCE A:       T4:343.ACC|    17                       15    |
|[38]      |                         0| [40]                             |
|          |SOURCE B:            3600|                                   |
|          |                      3600|                                   |
|          +--------------------------+                                   |
|          T4:343.ACC - [39]                                              |
Rung #042
|                                                           COMPRESSOR   |
|                                                           4 REGEN-     |
|  REGENERATE              ABORT CRYO                       ERATION      |
|  CRYO 4                  TIMER                            PROGRAM      |
|  TS04                    ABORTCRYO                        CYRGN4       |
|    N7:15                   T4:297                            B3        |
|-+---] [-----------------+---]/[-------------------------+-----(L)----+-|
| |    12                 |    TT                         |     324    | |
| |[2:3]                  | [27]                          |            | |
| |                       |                               |MANUAL      | |
| |                       | B3/324 - ] [ - File #2 MAIN_PRGRM - 111, 123, 124, 470, 472, 474
| |                       |                File #3 CRYO_REGEN - 43, 45, 69, 76, 212, 247, 254,
| |                       |                259
| |                       |                File #6 TECH_RUNGS - 14
| |                       |          ]/[ - File #2 MAIN_PRGRM - 29, 123, 124
| |HI_STAG                |                File #3 CRYO_REGEN - 33, 119, 137, 149, 180, 212, 226,
| | +-GEQ----------------------+           233
| +-|GRTR THAN OR EQUAL (A>=B) |-+  -(U)- - File #3 CRYO_REGEN - 240
|   |SOURCE A:       T4:197.ACC| N7:36/12 - -(U)- - File #3 CRYO_REGEN - 240
|   |                         0| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2
|   |SOURCE B:               15|
|   |                        15|
|   +--------------------------+
|  T4:197.ACC - [2:20]

  (output branch, Rung #042):
   |MANUAL
   |COMPRESSOR 4
   |REGENERATION
   |ENABLE
   |MC4RE
   |   N7:36
   +---(L)---
        12
```

485

Rung #043

COMPRESSOR 4 REGENERATION PROGRAM CYRGN4 — B3 324 [42]

HEATER 3 CHAMBER GATE VALVE CLOSED HV5S1 — I:024 00

REGEN COMP. 4 PULSE TIMER CR4PT
TON
TIMER ON DELAY —(EN)
TIMER: T4:64
BASE (SEC): 1.0 —(DN)
PRESET: 1
ACCUM: 0

SIEVE TRAP 4 TIMER S_TRAP_4
TON
TIMER ON DELAY —(EN)
TIMER: T4:344
BASE (SEC): 1.0 —(DN)
PRESET: 5400
ACCUM: 0

T4:64.TT - ┤ ├ - File #3 CRYO_REGEN - 76, 83, 90
T4:344.ACC - LEQ - File #3 CRYO_REGEN - 45
T4:344.TT - ┤ ├ - File #3 CRYO_REGEN - 44, 263
┤/├ - File #3 CRYO_REGEN - 264

Rung #044

S_TRAP_4 T4:344 TT [43]

OR: OPEN CRYO ROUGH VALVE 5 CR5 O:027 12 [166]

MECHANICAL PUMP 2 ISOLATION VALVE OPEN MP2IVOP — I:025 13

SIEVE TRAP ISOLATION VALVE 5 SVIV5 — O:031 ( ) 05

O:031/05 - ┤ ├ - File #3 CRYO_REGEN - 45

Rung #045

COMPRESSOR 4 REGENERATION PROGRAM CYRGN4 — B3 324 [42]

S_TRAP_4
LEQ
LESS THAN OR EQUAL (A<=B)
SOURCE A: T4:344.ACC
0
SOURCE B: 3600
3600

T4:344.ACC - [43]

SIEVE TRAP ISOLATION VALVE 5 SVIV5 — O:031 05 [44]

SIEVE TRAP HEATER 5 SVHTR5 — O:027 ( ) 15

Rung #046

REGENERATE CRYO 5 TS05 N7:15 —] [— 13 [2:3]

ABORT CRYO TIMER ABORTCRYO T4:297 —]/[— TT [27]

COMPRESSOR 5 REGEN-ERATION PROGRAM CYRGN5 B3 —(L)— 325

MANUAL COMPRESSOR 5 REGENERATION ENABLE MCSRE N7:36 —(L)— 13

HI_STAG
GEQ
GRTR THAN OR EQUAL (A>=B)
SOURCE A: T4:197.ACC 0
SOURCE B: 20 20

B3/325 -] [- File #2 MAIN_PRGRM - 111, 112, 121, 122, 125, 126, 127, 128, 468, 476, 478, 480, 482
File #3 CRYO_REGEN - 47, 51, 70, 77, 213, 248, 255, 259
File #6 TECH_RUNGS - 14
]/[- File #2 MAIN_PRGRM - 30, 121, 122, 125, 126, 127, 128
File #3 CRYO_REGEN - 33, 120, 121, 122, 138, 147, 151, 153, 182, 213, 227, 234
—(U)— - File #3 CRYO_REGEN - 241
N7:36/13 - —(U)— - File #3 CRYO_REGEN - 241
_F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2

T4:197.ACC - [2:20]

Rung #047

COMPRESSOR 5 REGEN-ERATION PROGRAM CYRGN5 B3 —] [— 325 [46]

DWELL 2 CHAMBER GATE VALVE CLOSED HV4S1 I:022 —] [— 06

DWELL 3 CHAMBER GATE VALVE CLOSED HV6S1 I:024 —] [— 03

DWELL 4 CHAMBER GATE VALVE CLOSED HV7S1 I:036 —] [— 06

REGEN COMP. 5 PULSE TIMER CR5PT
TON
TIMER ON DELAY —(EN)—
TIMER: T4:65
BASE (SEC): 1.0 —(DN)
PRESET: 65
ACCUM: 0

SIEVE TRAP 5 TIMER S_TRAP_5
TON
TIMER ON DELAY —(EN)—
TIMER: T4:345
BASE (SEC): 1.0 —(DN)
PRESET: 5400
ACCUM: 0

T4:65.TT -] [- File #3 CRYO_REGEN - 77, 84, 91, 92, 93
T4:345.ACC - LEQ - File #3 CRYO_REGEN - 51
T4:345.TT -] [- File #3 CRYO_REGEN - 48, 49, 50, 263
]/[- File #3 CRYO_REGEN - 264

Rung #048

```
                MECHANICAL                                              SIEVE TRAP
                PUMP 2                                                  ISOLATION VALVE
                ISOLATION                                               4
                VALVE OPEN                                              SVIV4
 S_TRAP_5       MP2IVOP                                                    O:031
  T4:345         I:025
--| |------------| |------------------------------------------------------( )--
    TT            13                                                        04
 [47]
                O:031/04 - -| |- - File #3 CRYO_REGEN - 51
 OPEN
 CRYO ROUGH
 VALVE 4
 CR4
    O:027
 ---| |---
     11
 [167]
```

Rung #049

```
                MECHANICAL                                              SIEVE TRAP
                PUMP 2                                                  ISOLATION VALVE
                ISOLATION                                               6
                VALVE OPEN                                              SVIV6
 S_TRAP_5       MP2IVOP                                                    O:031
  T4:345         I:025
--| |------------| |------------------------------------------------------( )--
    TT            13                                                        06
 [47]
                O:031/06 - -| |- - File #3 CRYO_REGEN - 51
 OPEN
 CRYO ROUGH
 VALVE 6
 CR6
    O:027
 ---| |---
     13
 [168]
```

Rung #050

```
                MECHANICAL                                              SIEVE TRAP
                PUMP 2                                                  ISOLATION VALVE
                ISOLATION                                               7
                VALVE OPEN                                              SVIV7
 S_TRAP_5       MP2IVOP                                                    O:031
  T4:345         I:025
--| |------------| |------------------------------------------------------( )--
    TT            13                                                        07
 [47]
                O:031/07 - -| |- - File #3 CRYO_REGEN - 51
 OPEN
 CRYO ROUGH
 VALVE 7
 CR7
    O:043
 ---| |---
     11
 [169]
```

Rung #051

```
|COMPRESSOR
|5 REGEN-                                                                 SIEVE TRAP
|ERATION                                                                  ISOLATION VALVE  SIEVE TRAP
|PROGRAM                                                                  4                HEATER 4
|CYRGN5      S_TRAP_5                                                     SVIV4            SVHTR4
|   B3      +--LEQ----------------------+                                     O:031           O:027
|---] [-----+LESS THAN OR EQUAL (A<=B)+-------------------------------+------] [------------( )---+
|   325     |SOURCE A:       T4:345.ACC|                               |      04               14   |
|[46]       |                         0|                               |[48]                        |
|           |SOURCE B:             3600|                               |                            |
|           |                      3600|                               |                            |
|           +--------------------------+                               |                            |
|           T4:345.ACC - [47]                                          |SIEVE TRAP                  |
|                                                                      |ISOLATION VALVE  SIEVE TRAP |
|                                                                      |6                HEATER 6   |
|                                                                      |SVIV6            SVHTR6     |
|                                                                      |     O:031           O:027  |
|                                                                      +------] [------------( )---+
|                                                                      |      06               17   |
|                                                                      |[49]                        |
|                                                                      |SIEVE TRAP                  |
|                                                                      |ISOLATION VALVE  SIEVE TRAP |
|                                                                      |7                HEATER 7   |
|                                                                      |SVIV7            SVHTR7     |
|                                                                      |     O:031           O:030  |
|                                                                      +------] [------------( )---+
                                                                              07               12
                                                                       [50]
```

Rung #052

```
|                                                                          COMPRESSOR
|                                                                          6 REGEN-
| REGENERATE                 ABORT CRYO                                    ERATION
| CRYO 6                     TIMER                                         PROGRAM
| TS06                       ABORTCRYO                                     CYRGN6
|    N7:15                      T4:297                                        B3
|-+---] [--------------------+----]/[-------------------------------------+---(L)-----+
| |    14                    |     TT                                     |   326     |
| |[2:3]                     | [27]                                     |           |
| |                          |                                          |MANUAL     |
| |                          | B3/326 - ] [ - File #2 MAIN_PRGRM - 112, 129, 130, 484, 486
| |                          |             File #3 CRYO_REGEN - 54, 56, 71, 78, 214, 249, 256,
| |                          |             259                          |COMPRESSOR 6
| |                          |             File #6 TECH_RUNGS - 14      |REGENERATION
| |                          |       ]/[ - File #2 MAIN_PRGRM - 31, 129, 130  |ENABLE
| |HI_STAG                   |             File #3 CRYO_REGEN - 33, 123, 139, 155, 184, 214, 228,
| |+--GEQ-------------------+|             235                          |MC6RE
| +GRTR THAN OR EQUAL (A>=B)+       -(L)- - File #3 CRYO_REGEN - 53     |   N7:36   |
|  |SOURCE A:     T4:197.ACC|       -(U)- - File #3 CRYO_REGEN - 242    +---(L)-----+
|  |                       0|   N7:36/14 - -(L)- - File #3 CRYO_REGEN - 53    14
|  |SOURCE B:             25|              -(U)- - File #3 CRYO_REGEN - 242
|  |                      25|   _F:N7:211%21 - BTW - File #2 MAIN_PRGRM - 2
|  +------------------------+
|  T4:197.ACC - [2:20]
```

Rung #053

```
|                                                                                    COMPRESSOR      |
|                                                                                    6 REGEN-        |
| REGENERATE                 ABORT CRYO                                              ERATION         |
| CRYO 6                     TIMER                                                   PROGRAM         |
| TS06                       ABORTCRYO                                               CYRGN6          |
|   N7:15                      T4:297                                                   B3           |
|---| |----------------------+---|/|---------------------------------------------+------(L)-----+--|
| |    14                    |    TT                                            |      326     |  |
| | [2:3]                    | [27]                                             |              |  |
| |                          |                                                  |MANUAL        |  |
| |                          | B3/326 - -| |- - File #2 MAIN_PRGRM - 112, 129, 130, 484, 486   |  |
| |                          |                 File #3 CRYO_REGEN - 54, 56, 71, 78, 214, 249, 256,|  |
| |                          |                 259                              |COMPRESSOR 6  |  |
| |                          |                 File #6 TECH_RUNGS - 14          |REGENERATION  |  |
| |                          |            -|/|- - File #2 MAIN_PRGRM - 31, 129, 130  |ENABLE    |  |
| |                          |                 File #3 CRYO_REGEN - 33, 123, 139, 155, 184, 214, 228,|
| |HI_STAG                   |                 235                              |MC6RE         |  |
| |--GEQ---------------------|                                                  |  N7:36       |  |
| +-GRTR THAN OR EQUAL (A>=B)+            -(L)- - File #3 CRYO_REGEN - 52       +------(L)-----+  |
|  |SOURCE A:     T4:197.ACC|             -(U)- - File #3 CRYO_REGEN - 242             14          |
|  |                       0|  N7:36/14 - -(L)- - File #3 CRYO_REGEN - 52                          |
|  |SOURCE B:             25|              -(U)- - File #3 CRYO_REGEN - 242                        |
|  |                      25|  _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2                         |
|  --------------------------                                                                      |
| T4:197.ACC - [2:20]
```

Rung #054

```
  MPRESSOR  BUFFER 3                                                                              |
|  REGEN-   CHAMBER                                                                                |
|ERATION    GATE VALVE                                              REGEN COMP. 6                  |
|PROGRAM    CLOSED                                                  PULSE TIMER                    |
|CYRGN6     HV8S1                                                   CR6PT                          |
|  B3         I:040                                                 +--TON----------------+        |
|---| |--------| |--------------------------------------------------+-TIMER ON DELAY      +-(EN)-+-|
|   326         00                                                 ||TIMER:        T4:66|      |  |
|[53]                                                              ||BASE (SEC):     1.0+-(DN) |  |
|                                                                  ||PRESET:            1|      |  |
| T4:66.TT - -| |- - File #3 CRYO_REGEN - 78, 85, 94               ||ACCUM:             0|      |  |
| T4:346.ACC - LEQ - File #3 CRYO_REGEN - 56                        |+--------------------+      |  |
| T4:346.TT - -| |- - File #3 CRYO_REGEN - 55, 263                  |                            |  |
|            -|/|- - File #3 CRYO_REGEN - 264                       |SIEVE TRAP                  |  |
|                                                                   |6 TIMER                     |  |
|                                                                   |S_TRAP_6                    |  |
|                                                                   |+--TON----------------+     |  |
|                                                                   +-TIMER ON DELAY      +-(EN)-+  |
|                                                                    |TIMER:       T4:346|         |
|                                                                    |BASE (SEC):     1.0+-(DN)    |
|                                                                    |PRESET:        5400|         |
|                                                                    |ACCUM:            0|         |
|                                                                    +--------------------+         |
```

Rung #055

```
|              MECHANICAL
|              PUMP 2                                                              SIEVE TRAP
|              ISOLATION                                                           ISOLATION VALVE
|              VALVE OPEN                                                          8
|  S_TRAP_6    MP2IVOP                                                             SVIV8
|   T4:346       I:025                                                               O:031
|-+--| |---+-----| |-----------------------------------------------------------------( )---|
| |   TT   |      13                                                                   10
| |[54]    |
| |        | O:031/10 - -| |- - File #3 CRYO_REGEN - 56
| |OPEN    |
| |CRYO ROUGH
| |VALVE 8 |
| |CR8     |
| |  O:043 |
| +--| |---+
|     12
|  [170]
```

Rung #056

```
|COMPRESSOR
|6 REGEN-
|ERATION                           SIEVE TRAP
|PROGRAM                           ISOLATION VALVE                                SIEVE TRAP
|CYRGN6      S_TRAP_6              8                                              HEATER 8
|   B3       +-LEQ-----------------+ SVIV8                                        SVHTR8
|--| |-------+LESS THAN OR EQUAL (A<=B)+   O:031                                    O:031
|   326      |SOURCE A:    T4:346.ACC|----| |----------------------------------------( )---|
|[53]        |                      0| [55] 10                                        17
|            |SOURCE B:          3600|
|            |                   3600|
|            +-----------------------+
|            T4:346.ACC - [54]
```

Rung #057

```
|                                                                                COMPRESSOR
|                                                                                7 REGEN-
|  REGENERATE                     ABORT CRYO                                     ERATION
|  CRYO 7                         TIMER                                          PROGRAM
|  TS07                           ABORTCRYO                                      CYRGN7
|    N7:15                          T4:297                                          B3
|-+-+--| |------------------+-------|/|----------------------------------------+---(L)---+-|
| | |   15                  |        TT                                        |   327   |
| | |[2:3]                  |  [27]                                            |         |
| | |                       |                                                  |MANUAL   |
| | |                       |  B3/327 - -| |- - File #2 MAIN_PRGRM - 113, 114, 131, 132, 133, 134, 137,
| | |                       |                    138, 488, 490, 492, 494, 500, 502       |COMPRESSOR 7
| | |                       |                    File #3 CRYO_REGEN - 58, 62, 72, 79, 215, 250, 257,
| | |                       |                    259                                     |REGENERATION
| | |                       |                    File #6 TECH_RUNGS - 14                 |ENABLE
| | |HI_STAG                |          -|/|- - File #2 MAIN_PRGRM - 32, 131, 132, 133, 134, 137, 138
| | +-GEQ-------------------+                    File #3 CRYO_REGEN - 33, 124, 125, 126, 140, 157, 159,
| +-GRTR THAN OR EQUAL (A>=B)+                   163, 186, 215, 229, 236               |MC7RE
|   |SOURCE A:   T4:197.ACC|           -(U)- - File #3 CRYO_REGEN - 243                 |  N7:36
|   |                     0|   N7:36/15 - -(U)- - File #3 CRYO_REGEN - 243            +---(L)---+
|   |SOURCE B:           30|   _F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2                 15
|   |                    30|
|   +----------------------+
|   T4:197.ACC - [2:20]
```

```
Rung #058
|COMPRESSOR DWELL 5     DWELL 6     EXITLOCK                                         |
|7 REGEN-   CHAMBER     CHAMBER     CHAMBER                                          |
|ERATION    GATE VALVE  GATE VALVE  GATE VALVE                 REGEN COMP. 7         |
|PROGRAM    CLOSED      CLOSED      CLOSED                     PULSE TIMER           |
|CYRGN7     HV9S1       HV10S1      HV12S1                     CR7PT                 |
|    B3       I:040       I:052       I:054                    +-TON---------------+ |
|----] [--------] [---------] [---------] [--------------------+TIMER ON DELAY     +-(EN)-+-
|   327         03          06          03                    ||TIMER:       T4:67|       | |
|[57]                                                         ||BASE (SEC):    1.0+-(DN)  | |
|                                                             ||PRESET:          1|       | |
| T4:67.TT - ] [ - File #3 CRYO_REGEN - 79, 86, 95, 96, 97    ||ACCUM:           0|       | |
| T4:347.ACC - LEQ - File #3 CRYO_REGEN - 62                  |+------------------+       | |
| T4:347.TT - ] [ - File #3 CRYO_REGEN - 59, 60, 61, 263      |                           | |
|             ]/[ - File #3 CRYO_REGEN - 264                  |                           | |
|                                                             |SIEVE TRAP                 | |
|                                                             |7 TIMER                    | |
|                                                             |S_TRAP_7                   | |
|                                                             | +-TON---------------+     | |
|                                                             +-+TIMER ON DELAY     +-(EN)-+ |
|                                                               |TIMER:      T4:347|         |
|                                                               |BASE (SEC):    1.0+-(DN)    |
|                                                               |PRESET:       5400|         |
|                                                               |ACCUM:           0|         |
|                                                               +------------------+         |
Rung #059
                MECHANICAL                                                            |
                PUMP 2                                            SIEVE TRAP          |
|               ISOLATION                                         ISOLATION VALVE     |
|               VALVE OPEN                                        9                   |
|  S_TRAP_7     MP2IVOP                                           SVIV9               |
|   T4:347        I:025                                               O:045           |
|-+---] [----+------] [-------------------------------------------------( )----------|
| |   TT     |      13                                                  04            |
| |[58]      |                                                                        |
| |          | O:045/04 - ] [ - File #3 CRYO_REGEN - 62                               |
| |OPEN      |                                                                        |
| |CRYO ROUGH|                                                                        |
| |VALVE 9   |                                                                        |
| |CR9       |                                                                        |
| |  O:043   |                                                                        |
| +---] [----+                                                                        |
|      13                                                                             |
|  [171]                                                                              |
Rung #060
|               MECHANICAL                                                            |
|               PUMP 2                                            SIEVE TRAP          |
|               ISOLATION                                         ISOLATION VALVE     |
|               VALVE OPEN                                        10                  |
|  S_TRAP_7     MP2IVOP                                           SVIV10              |
|   T4:347        I:025                                               O:045           |
|-+---] [----+------] [-------------------------------------------------( )----------|
| |   TT     |      13                                                  05            |
| |[58]      |                                                                        |
| |          | O:045/05 - ] [ - File #3 CRYO_REGEN - 62                               |
| |OPEN      |                                                                        |
| |CRYO ROUGH|                                                                        |
| |VALVE 10  |                                                                        |
| |CR10      |                                                                        |
| |  O:057   |                                                                        |
| +---] [----+                                                                        |
|      11                                                                             |
|  [172]                                                                              |
```

493

```
Rung #061
                       MECHANICAL
                       PUMP 2
                       ISOLATION                                                   SIEVE TRAP
                       VALVE OPEN                                                  ISOLATION VALVE
  S_TRAP_7             MP2IVOP                                                     12
   T4:347               I:025                                                      SVIV12
                                                                                      O:045
|--] [-----------------] [------------------------------------------------------------( )--|
     TT                  13                                                            07
  [58]
                       O:045/07 - ] [ - File #3 CRYO_REGEN - 62
  OPEN
  CRYO ROUGH
  VALVE 12
  CR12
    O:057
  |--] [--|
      13
  [173]
Rung #062
COMPRESSOR
7 REGEN-
ERATION                                                              SIEVE TRAP
PROGRAM                                                              ISOLATION VALVE   SIEVE TRAP
CYRGN7       S_TRAP_7                                                9                 HEATER 9
   B3        LEQ                                                     SVIV9             SVHTR9
             LESS THAN OR EQUAL (A<=B)                                  O:045             O:043
|--] [------|SOURCE A:         T4:347.ACC|------------------------------] [---------------( )--|
   327      |                           0|                                 04                00
[57]        |SOURCE B:              3600|                               [59]
            |                       3600|
             T4:347.ACC - [58]                                       SIEVE TRAP
                                                                     ISOLATION VALVE   SIEVE TRAP
                                                                     10                HEATER 10
                                                                     SVIV10            SVHTR10
                                                                        O:045             O:043
                                                                     |--] [---------------( )--|
                                                                         05                01
                                                                     [60]
                                                                     SIEVE TRAP
                                                                     ISOLATION VALVE   SIEVE TRAP
                                                                     12                HEATER 12
                                                                     SVIV12            SVHTR12
                                                                        O:045             O:044
                                                                     |--] [---------------( )--|
                                                                         07                02
                                                                     [61]
```

Rung #063

```
                                                                       COMPRESSOR
                                                                       8 REGEN-
 REGENERATE   ABORT CRYO                                               ERATION
 CRYO 8       TIMER                                                    PROGRAM
 TS08         ABORTCRYO                                                CYRGN8
   N7:16        T4:297                                                   B3
|---| |---+-----|/|------------------------------------------------+-----(L)-----|
|     0   |      TT                                                |     328
|  [2:3]  | [27]                                                   |
|         |                                                        | MANUAL
|         | B3/328 - -| |- - File #2 MAIN_PRGRM - 113, 135, 136, 496, 498      | COMPRESSOR 8
|         |                  File #3 CRYO_REGEN - 64, 66, 73, 80, 216, 251, 258, 259 | REGENERATION
|         |                  File #6 TECH_RUNGS - 14               | ENABLE
|         |          -|/|- - File #2 MAIN_PRGRM - 33, 135, 136     | MC8RE
|         |                  File #3 CRYO_REGEN - 33, 127, 141, 161, 188, 216, 230, 237
|         |                                                        |     N7:37
| HI_STAG |          -(U)- - File #3 CRYO_REGEN - 244              +-----(L)-----
|  T4:197 | N7:37/0 - -(U)- - File #3 CRYO_REGEN - 244                    0
+---| |---+ _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2
     DN
   [2:20]
```

Rung #064

```
 COMPRESSOR  BUFFER 4
 8 REGEN-    CHAMBER
 ERATION     GATE VALVE                                   REGEN COMP. 8
 PROGRAM     CLOSED                                       PULSE TIMER
 CYRGN8      HV11S1                                       CR8PT
   B3          I:054                                     +-TON----------------+
|---| |---------| |--------------------------------------+-|TIMER ON DELAY     |-(EN)-+
   328          00                                       | |TIMER:      T4:68 |      |
 [63]                                                    | |BASE (SEC):   1.0 |-(DN) |
                                                         | |PRESET:         1 |      |
 T4:68.TT - -| |- - File #3 CRYO_REGEN - 80, 87, 98      | |ACCUM:          0 |      |
 T4:348.ACC - LEQ - File #3 CRYO_REGEN - 66              | +------------------+      |
 T4:348.TT - -| |- - File #3 CRYO_REGEN - 65, 263        |                           |
             -|/|- - File #3 CRYO_REGEN - 264            | SIEVE TRAP                |
                                                         | 8 TIMER                   |
                                                         | S_TRAP_8                  |
                                                         | +-TON----------------+    |
                                                         +-|TIMER ON DELAY      |-(EN)-+
                                                           |TIMER:     T4:348   |
                                                           |BASE (SEC):   1.0   |-(DN)
                                                           |PRESET:      5400   |
                                                           |ACCUM:          0   |
                                                           +--------------------+
```

```
Rung #065
|                    MECHANICAL                                                              |
|                    PUMP 2                                                     SIEVE TRAP   |
|                    ISOLATION                                                  ISOLATION VALVE
|                    VALVE OPEN                                                 11           |
|  S_TRAP_8          MP2IVOP                                                    SVIV11       |
|   T4:348             I:025                                                       O:045     |
|-+---| |-------+-------| |---------------------------------------------------------( )------|
| |     TT      |        13                                                          06      |
| |[64]         |                                                                            |
| |OPEN         |                                                                            |
| |CRYO ROUGH   |                                                                            |
| |VALVE 11     |                                                                            |
| |CR11         |                                                                            |
| |   O:057     |                                                                            |
| +---| |-------+                                                                            |
|      12                                                                                    |
| [174]                                                                                      |
Rung #066
|COMPRESSOR                                                                                  |
|8 REGEN-                                                                                    |
|ERATION                                                                     SIEVE TRAP      |
|PROGRAM                                                                     HEATER 11       |
|CYRGN8      S_TRAP_8                                                        SVHTR11         |
|    B3      +-LEQ---------------------+                                       O:043         |
|---| |------+LESS THAN OR EQUAL (A<=B)+----------------------------------------( )----------|
|   328      |SOURCE A:     T4:348.ACC|                                          02          |
|  [          |                      0|                                                      |
|            |SOURCE B:          3600|                                                       |
|            |                   3600|                                                       |
|            +-----------------------+                                                      |
|            T4:348.ACC - [64]                                                               |
Rung #067
|COMPRESSOR                                                                                  |
|2 REGEN-                                                                    SCREEN          |
|ERATION                                                                     REGENERATION    |
|PROGRAM                                                                     CRYO 2          |
|CYRGN2                                                                      SCRRGN2         |
|    B3                                                                          B3          |
|---| |--------------------------------------------------------------------------( )---------|
|   322                                                                          802         |
|[34]                                                                                        |
Rung #068
|COMPRESSOR                                                                                  |
|3 REGEN-                                                                    SCREEN          |
|ERATION                                                                     REGENERATION    |
|PROGRAM                                                                     CRYO 3          |
|CYRGN3                                                                      SCRRGN3         |
|    B3                                                                          B3          |
|---| |--------------------------------------------------------------------------( )---------|
|   323                                                                          803         |
|[38]                                                                                        |
Rung #069
|COMPRESSOR                                                                                  |
|4 REGEN-                                                                    SCREEN          |
|ERATION                                                                     REGENERATION    |
|PROGRAM                                                                     CRYO 4          |
|CYRGN4                                                                      SCRRGN4         |
|    B3                                                                          B3          |
|---| |--------------------------------------------------------------------------( )---------|
|   324                                                                          804         |
|[42]                                                                                        |
```

496

```
Rung #070
|COMPRESSOR
|5 REGEN-                                                              SCREEN
|ERATION                                                               REGENERATION
|PROGRAM                                                               CRYO 5
|CYRGN5                                                                SCRRGN5
|     B3                                                                   B3
|----| |--------------------------------------------------------------------( )----|
|    325                                                                   805
|[46]
Rung #071
|COMPRESSOR
|6 REGEN-                                                              SCREEN
|ERATION                                                               REGENERATION
|PROGRAM                                                               CRYO 6
|CYRGN6                                                                SCRRGN6
|     B3                                                                   B3
|----| |--------------------------------------------------------------------( )----|
|    326                                                                   806
|[53]
Rung #072
|COMPRESSOR
|7 REGEN-                                                              SCREEN
|ERATION                                                               REGENERATION
|PROGRAM                                                               CRYO 7
|CYRGN7                                                                SCRRGN7
|     B3                                                                   B3
|----| |--------------------------------------------------------------------( )----|
|    327                                                                   807
|[57]
Rung #073
|COMPRESSOR
|8 REGEN-                                                              SCREEN
|ERATION                                                               REGENERATION
|PROGRAM                                                               CRYO 8
|CYRGN8                                                                SCRRGN8
|     B3                                                                   B3
|----| |--------------------------------------------------------------------( )----|
|    328                                                                   808
|[63]
Rung #074
|COMPRESSOR
|2 REGEN-
|ERATION      CRYO REGEN
|PROGRAM      2 PULSE                                                     PURGE 2
|CYRGN2       CR2PT                                                       P2
|     B3         T4:62                                                      B3
|----| |----------| |-------------------------------------------------------(L)----|
|    322           TT                                                       632
 [34]        [35]
B3/632 - -| |- - File #3 CRYO_REGEN -  88,110,128
                 File #6 TECH_RUNGS -  15
       -(L)- - File #3 CRYO_REGEN -  74
       -(U)- - File #3 CRYO_REGEN -  135
```

Rung #075

```
|COMPRESSOR                                                                        |
|3 REGEN-                                                                          |
|ERATION      CRYO REGEN                                                           |
|PROGRAM      3 PULSE                                                    PURGE 3   |
|CYRGN3       CR3PT                                                      P3        |
|      B3          T4:63                                                   B3      |
|-----] [---------] [-------------------------------------------------------(L)----|
|      323          TT                                                     633     |
|[38]         [39]                                                                 |
B3/633 - ] [ - File #3 CRYO_REGEN -  89,111,129
               File #6 TECH_RUNGS -  15
         -(L)- - File #3 CRYO_REGEN -  75
         -(U)- - File #3 CRYO_REGEN -  136
```

Rung #076

```
|COMPRESSOR                                                                        |
|4 REGEN-                                                                          |
|ERATION      CRYO REGEN                                                           |
|PROGRAM      4 PULSE                                                    PURGE 4   |
|CYRGN4       CR4PT                                                      P4        |
|      B3          T4:64                                                   B3      |
|-----] [---------] [-------------------------------------------------------(L)----|
|      324          TT                                                     634     |
|[42]         [43]                                                                 |
B3/634 - ] [ - File #3 CRYO_REGEN -  90,112,130
               File #6 TECH_RUNGS -  15
         -(L)- - File #3 CRYO_REGEN -  76
         -(U)- - File #3 CRYO_REGEN -  137
```

..ung #077

```
|COMPRESSOR                                                                        |
|5 REGEN-                                                                          |
|ERATION      CRYO REGEN                                                           |
|PROGRAM      5 PULSE                                                    PURGE 5   |
|CYRGN5       CR5PT                                                      P5        |
|      B3          T4:65                                                   B3      |
|-----] [---------] [-------------------------------------------------------(L)----|
|      325          TT                                                     635     |
|[46]         [47]                                                                 |
B3/635 - ] [ - File #3 CRYO_REGEN -  91,92,93,113,131
               File #6 TECH_RUNGS -  15
         -(L)- - File #3 CRYO_REGEN -  77
         -(U)- - File #3 CRYO_REGEN -  138
```

Rung #078

```
|COMPRESSOR                                                                        |
|6 REGEN-                                                                          |
|ERATION      CRYO REGE]                                                           |
|PROGRAM      6 PULSE                                                    PURGE 6   |
|CYRGN6       CR6PT                                                      P6        |
|      B3          T4:66                                                   B3      |
 -----] [---------] [-------------------------------------------------------(L)----|
|      326          TT                                                     636     |
|[53]         [54]                                                                 |
B3/636 - ] [ - File #3 CRYO_REGEN -  94,114,132
               File #6 TECH_RUNGS -  15
         -(L)- - File #3 CRYO_REGEN -  78
         -(U)- - File #3 CRYO_REGEN -  139
```

```
Rung #079
|COMPRESSOR
|7 REGEN-
|ERATION     CRYO REGEN                                                    PURGE 7
|PROGRAM     7 PULSE                                                       P7
|CYRGN7      CR7PT                                                           B3
|    B3          T4:67
|----| |---------| |-----------------------------------------------------------(L)---|
|    327         TT                                                          637
|[57]        [58]
B3/637 - -| |- - File #3 CRYO_REGEN -  95,96,97,115,133
                 File #6 TECH_RUNGS -  15
         -(L)- - File #3 CRYO_REGEN -  79
         -(U)- - File #3 CRYO_REGEN -  140
Rung #080
|COMPRESSOR
|8 REGEN-
|ERATION     CRYO REGEN                                                    PURGE 8
|PROGRAM     8 PULSE                                                       P8
|CYRGN8      CR8PT                                                           B3
|    B3          T4:68
|----| |---------| |-----------------------------------------------------------(L)---|
|    328         TT                                                          638
|[63]        [64]
B3/638 - -| |- - File #3 CRYO_REGEN -  98,116,134
                 File #6 TECH_RUNGS -  15
         -(L)- - File #3 CRYO_REGEN -  80
         -(U)- - File #3 CRYO_REGEN -  141
Rung #081
|                                                                    ENABLE
|                                                                    CRYO
|  CRYO REGEN                                                        COMPRESSOR
|  2 PULSE                                                           2
|  CR2PT                                                             CY2
|      T4:62                                                           O:010
|-+------| |-----+----------------------------------------------------+----(U)-----+-|
| |         TT   |                                                    |     05     | |
| |[35]          |                                                    |            | |
| |              | O:010/05 - -| |- - File #2 MAIN_PRGRM - 436, 440   |            | |
| |              |                    File #3 CRYO_REGEN - 260        |MANUAL CRYO | |
| |              |                    File #6 TECH_RUNGS - 19         |COMPRESSOR 2| |
| |              |              -(L)- - File #2 MAIN_PRGRM - 27       |RUN         | |
| |              | N7:34/6 - -(L)- - File #2 MAIN_PRGRM - 27          |MCYC2RUN    | |
| |MAIN WATER ON | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2        |     N7:34  | |
| |MAIN_H20      | N7:29/6 - -(U)- - File #2 MAIN_PRGRM - 27          +----(U)-----+ |
| |     I:002    | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2        |      6     | |
| +------|/|-----+                                                    |            | |
| |      07      |                                                    |MANUAL CRYO | |
| |MANUAL        |                                                    |COMPRESSOR 2| |
| |CONTROL       |                                                    |STOP        | |
| |STOP CRYO     |                                                    |MCYC2STOP   | |
| |COMPRESSOR    |                                                    |     N7:29  | |
| |2             |                                                    +----(L)-----+ |
| |M-CY2-0       |                                                           6       |
| |    N7:8      |                                                                   |
| +-----| |------+                                                                   |
|        6                                                                           |
|  [2:3]
```

```
Rung #082

  CRYO REGEN                                                    ENABLE
  3 PULSE                                                       CRYO
  CR3PT                                                         COMPRESSOR
    T4:63                                                       3
                                                                CY3
                                                                  O:030
 --| |---------------------------------------------------------(U)--
     TT                                                            04
 [39]
        O:030/04 - -| |- - File #2 MAIN_PRGRM - 440
                           File #3 CRYO_REGEN - 260            MANUAL CRYO
                           File #6 TECH_RUNGS - 19             COMPRESSOR 3
                     -(L)- - File #2 MAIN_PRGRM - 28           RUN
        N7:34/7 - -(L)- - File #2 MAIN_PRGRM - 28              MCYC3RUN
 MAIN WATER ON  _F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2       N7:34
 MAIN_H20       N7:29/7 - -(U)- - File #2 MAIN_PRGRM - 28     ----(U)----
    I:002       _F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2        7
 ---|/|---
     07                                                        MANUAL CRYO
 MANUAL                                                        COMPRESSOR 3
 CONTROL                                                       STOP
 STOP CRYO                                                     MCYC3STOP
 COMPRESSOR                                                       N7:29
 3                                                             ----(L)----
 N-CY3-0                                                           7
    N7:8
 ---| |---
     7
 [2:3]

Rung #083

  CRYO REGEN                                                    ENABLE
  4 PULSE                                                       CRYO
  CR4PT                                                         COMPRESSOR
    T4:64                                                       4
                                                                CY4
                                                                  O:030
 --| |---------------------------------------------------------(U)--
     TT                                                            05
 [43]
        O:030/05 - -| |- - File #2 MAIN_PRGRM - 440
                           File #3 CRYO_REGEN - 260            MANUAL CRYO
                           File #6 TECH_RUNGS - 19             COMPRESSOR 4
                     -(L)- - File #2 MAIN_PRGRM - 29           RUN
        N7:34/8 - -(L)- - File #2 MAIN_PRGRM - 29              MCYC4RUN
 MAIN WATER ON  _F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2       N7:34
 MAIN_H20       N7:29/8 - -(U)- - File #2 MAIN_PRGRM - 29     ----(U)----
    I:002       _F:N7:21lX21 - BTW - File #2 MAIN_PRGRM - 2        8
 ---|/|---
     07                                                        MANUAL CRYO
 MANUAL                                                        COMPRESSOR 4
 CONTROL                                                       STOP
 STOP CRYO                                                     MCYC4STOP
 COMPRESSOR                                                       N7:29
 4                                                             ----(L)----
 N-CY4-0                                                           8
    N7:8
 ---| |---
     8
 [2:3]
```

```
Rung #084
                                                                     ENABLE
                                                                     CRYO
 CRYO REGEN                                                          COMPRESSOR
 5 PULSE                                                             5
 CR5PT                                                               CY5
    T4:65                                                              O:044
|---] [---+------------------------------------------------------+----(U)----|
|   TT    |                                                      |     04     |
| [47]    |                                                      |            |
|         | O:044/04 - -] [- - File #2 MAIN_PRGRM - 440, 444     |MANUAL CRYO |
|         |                    File #3 CRYO_REGEN - 260          |COMPRESSOR 5|
|         |                    File #6 TECH_RUNGS - 19           |RUN         |
|         |              -(L)- - File #2 MAIN_PRGRM - 30         |MCYC5RUN    |
|         | N7:34/9 - -(L)- - File #2 MAIN_PRGRM - 30            |    N7:34   |
|MAIN WATER ON _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2       +----(U)----+
|MAIN_H20 | N7:29/9 - -(U)- - File #2 MAIN_PRGRM - 30            |     9      |
|   I:002 | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2          |            |
+---]/[---+                                                      |MANUAL CRYO |
|    07   |                                                      |COMPRESSOR 5|
|MANUAL   |                                                      |STOP        |
|CONTROL  |                                                      |MCYC5STOP   |
|STOP CRYO|                                                      |    N7:29   |
|COMPRESSOR                                                      +----(L)----+
|5        |                                                            9
|M-CY5-0  |
|   N7:8  |
+---] [---+
     9
 [2:3]

Rung #085
                                                                     ENABLE
                                                                     CRYO
 CRYO REGEN                                                          COMPRESSOR
 6 PULSE                                                             6
 CR6PT                                                               CY6
    T4:66                                                              O:044
|---] [---+------------------------------------------------------+----(U)----|
|   TT    |                                                      |     05     |
| [54]    |                                                      |            |
|         | O:044/05 - -] [- - File #2 MAIN_PRGRM - 444          |MANUAL CRYO |
|         |                    File #3 CRYO_REGEN - 260          |COMPRESSOR 6|
|         |                    File #6 TECH_RUNGS - 19           |RUN         |
|         |              -(L)- - File #2 MAIN_PRGRM - 31         |MCYC6RUN    |
|         | N7:34/10 - -(L)- - File #2 MAIN_PRGRM - 31           |    N7:34   |
|MAIN WATER ON _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2       +----(U)----+
|MAIN_H20 | N7:29/10 - -(U)- - File #2 MAIN_PRGRM - 31           |     10     |
|   I:002 | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2          |            |
+---]/[---+                                                      |MANUAL CRYO |
|    07   |                                                      |COMPRESSOR 6|
|MANUAL   |                                                      |STOP        |
|CONTROL  |                                                      |MCYC6STOP   |
|STOP CRYO|                                                      |    N7:29   |
|COMPRESSOR                                                      +----(L)----+
|6        |                                                            10
|M-CY6-0  |
|   N7:8  |
+---] [---+
     10
 [2:3]
```

Rung #086

```
|                                                                          ENABLE        |
|                                                                          CRYO          |
| CRYO REGEN                                                               COMPRESSOR    |
| 7 PULSE                                                                  7             |
| CR7PT                                                                    CY7           |
|     T4:67                                                                   O:060      |
|-+----| |--------+-----------------------------------------------------+------(U)-----+-|
| |      TT       |                                                     |      04      | |
| |[58]           |                                                     |              | |
| |               | O:060/04 - -| |- - File #2 MAIN_PRGRM - 449, 453    |              | |
| |               |                    File #3 CRYO_REGEN - 260         |MANUAL CRYO   | |
| |               |                    File #6 TECH_RUNGS - 19          |COMPRESSOR 7  | |
| |               |               -(L)- - File #2 MAIN_PRGRM - 32       |RUN           | |
| |               | N7:34/11 - -(L)- - File #2 MAIN_PRGRM - 32          |MCYC7RUN      | |
| |MAIN WATER ON  | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2         |    N7:34     | |
| |MAIN_H20       | N7:29/11 - -(U)- - File #2 MAIN_PRGRM - 32          +------(U)-----+ |
| |     I:002     | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2         |      11      | |
| +------|/|------+                                                     |              | |
| |      07       |                                                     |              | |
| |MANUAL         |                                                     |MANUAL CRYO   | |
| |CONTROL        |                                                     |COMPRESSOR 7  | |
| |STOP CRYO      |                                                     |STOP          | |
| |COMPRESSOR     |                                                     |MCYC7STOP     | |
| |7              |                                                     |    N7:29     | |
| |N-CY7-0        |                                                     +------(L)-----+ |
| |     N7:8      |                                                            11        |
|  ------| |------+                                                                      |
|       11                                                                               |
| [2:3]                                                                                  |
```

Rung #087

```
|                                                                          ENABLE        |
|                                                                          CRYO          |
| CRYO REGEN                                                               COMPRESSOR    |
| 8 PULSE                                                                  8             |
| CR8PT                                                                    CY8           |
|     T4:68                                                                   O:060      |
|-+----| |--------+-----------------------------------------------------+------(U)-----+-|
| |      TT       |                                                     |      05      | |
| |[64]           |                                                     |              | |
| |               | O:060/05 - -| |- - File #2 MAIN_PRGRM - 449         |              | |
| |               |                    File #3 CRYO_REGEN - 260         |MANUAL CRYO   | |
| |               |                    File #6 TECH_RUNGS - 19          |COMPRESSOR 8  | |
| |               |               -(L)- - File #2 MAIN_PRGRM - 33       |RUN           | |
| |               | N7:34/12 - -(L)- - File #2 MAIN_PRGRM - 33          |MCYC8RUN      | |
| |MAIN WATER ON  | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2         |    N7:34     | |
| |MAIN_H20       | N7:29/12 - -(U)- - File #2 MAIN_PRGRM - 33          +------(U)-----+ |
| |     I:002     | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2         |      12      | |
| +------|/|------+                                                     |              | |
| |      07       |                                                     |              | |
| |MANUAL         |                                                     |MANUAL CRYO   | |
| |CONTROL        |                                                     |COMPRESSOR 8  | |
| |STOP CRYO      |                                                     |STOP          | |
| |COMPRESSOR     |                                                     |MCYC8STOP     | |
| |8              |                                                     |    N7:29     | |
| |N-CY8-0        |                                                     +------(L)-----+ |
| |     N7:8      |                                                            12        |
| +------| |------+                                                                      |
|       12                                                                               |
| [2:3]                                                                                  |
```

502

```
Rung #088
|                       OPEN                                                    OPEN PURGE |
|         CRYO REGEN   CRYO ROUGH                                               VALVE 2    |
|PURGE 2  2 PULSE      VALVE 2                                                  NIF2       |
|P2       CR2PT        CR2                                                        0:007    |
|  B3       T4:62        0:007                                                             |
|--] [-------] [----------]/[----------------------------------------------------(L)------|
|  632        TT           12                                                       07     |
|[74]     [35]          [164]
0:007/07 - -] [- - File #3 CRYO_REGEN -  99
                   File #6 TECH_RUNGS -  16
          -(L)- - File #3 CRYO_REGEN -  88
          -(U)- - File #3 CRYO_REGEN -  117
Rung #089
|                       OPEN                                                    OPEN PURGE |
|         CRYO REGEN   CRYO ROUGH                                               VALVE 3    |
|PURGE 3  3 PULSE      VALVE 3                                                  NIF3       |
|P3       CR3PT        CR3                                                        0:007    |
|  B3       T4:63        0:007                                                             |
|--] [-------] [----------]/[----------------------------------------------------(L)------|
|  633        TT           13                                                       10     |
|[75]     [39]          [165]
0:007/10 - -] [- - File #3 CRYO_REGEN -  100
                   File #6 TECH_RUNGS -  16
          -(L)- - File #3 CRYO_REGEN -  89
          -(U)- - File #3 CRYO_REGEN -  118
Rung #090
                        OPEN                                                    OPEN PURGE |
|         CRYO REGEN   CRYO ROUGH                                               VALVE 5    |
|PURGE 4  4 PULSE      VALVE 5                                                  NIF5       |
|P4       CR4PT        CR5                                                        0:027    |
|  B3       T4:64        0:027                                                             |
|--] [-------] [----------]/[----------------------------------------------------(L)------|
|  634        TT           12                                                       07     |
|[76]     [43]          [166]
0:027/07 - -] [- - File #3 CRYO_REGEN -  102
                   File #6 TECH_RUNGS -  16
          -(L)- - File #3 CRYO_REGEN -  90
          -(U)- - File #3 CRYO_REGEN -  119
Rung #091
|                       OPEN                                                    OPEN PURGE |
|         CRYO REGEN   CRYO ROUGH                                               VALVE 4    |
|PURGE 5  5 PULSE      VALVE 4                                                  NIF4       |
|P5       CR5PT        CR4                                                        0:027    |
|  B3       T4:65        0:027                                                             |
|--] [-------] [----------]/[----------------------------------------------------(L)------|
|  635        TT           11                                                       06     |
|[77]     [47]          [167]
0:027/06 - -] [- - File #3 CRYO_REGEN -  101
                   File #6 TECH_RUNGS -  16
          -(L)- - File #3 CRYO_REGEN -  91
          -(U)- - File #3 CRYO_REGEN -  120
Rung #092
|                       OPEN                                                    OPEN PURGE |
|         CRYO REGEN   CRYO ROUGH                                               VALVE 6    |
|PURGE 5  5 PULSE      VALVE 6                                                  NIF6       |
|P5       CR5PT        CR6                                                        0:027    |
|  B3       T4:65        0:027                                                             |
|--] [-------] [----------]/[----------------------------------------------------(L)------|
|  635        TT           13                                                       10     |
|[77]     [47]          [168]
0:027/10 - -] [- - File #3 CRYO_REGEN -  103
```

```
                File #6 TECH_RUNGS -  16
           -(L)- - File #3 CRYO_REGEN -  92
           -(U)- - File #3 CRYO_REGEN -  121
Rung #093
|                     OPEN                                                              |
|         CRYO REGEN  CRYO ROUGH                                             OPEN PURGE |
|PURGE 5  5 PULSE     VALVE 7                                                VALVE 7    |
|P5       CR5PT       CR7                                                    NIF7       |
|  B3        T4:65       O:043                                                 O:043    |
|--] [--------] [---------]/[-------------------------------------------------------(L)--|
|  635         TT          11                                                    06     |
|[77]     [47]        [169]                                                             |
O:043/06 - ] [ - - File #3 CRYO_REGEN -  104
                File #6 TECH_RUNGS -  16
           -(L)- - File #3 CRYO_REGEN -  93
           -(U)- - File #3 CRYO_REGEN -  122
Rung #094
|                     OPEN                                                              |
|         CRYO REGEI  CRYO ROUGH                                             OPEN PURGE |
|PURGE 6  6 PULSE     VALVE 8                                                VALVE 8    |
|P6       CR6PT       CR8                                                    NIF8       |
|  B3        T4:66       O:043                                                 O:043    |
|--] [--------] [---------]/[-------------------------------------------------------(L)--|
|  636         TT          12                                                    07     |
|[78]     [54]        [170]                                                             |
O:043/07 - ] [ - - File #3 CRYO_REGEN -  106
                File #6 TECH_RUNGS -  16
           -(L)- - File #3 CRYO_REGEN -  94
           -(U)- - File #3 CRYO_REGEN -  123
Rung #095
|                     OPEN                                                              |
|         CRYO REGEN  CRYO ROUGH                                             OPEN PURGE |
|PURGE 7  7 PULSE     VALVE 9                                                VALVE 9    |
|P7       CR7PT       CR9                                                    NIF9       |
|  B3        T4:67       O:043                                                 O:043    |
|--] [--------] [---------]/[-------------------------------------------------------(L)--|
|  637         TT          13                                                    10     |
|[79]     [58]        [171]                                                             |
O:043/10 - ] [ - - File #3 CRYO_REGEN -  105
                File #6 TECH_RUNGS -  16
           -(L)- - File #3 CRYO_REGEN -  95
           -(U)- - File #3 CRYO_REGEN -  124
Rung #096
|                     OPEN                                                              |
|         CRYO REGEN  CRYO ROUGH                                             OPEN PURGE |
|PURGE 7  7 PULSE     VALVE 10                                               VALVE 10   |
|P7       CR7PT       CR10                                                   NIF10      |
|  B3        T4:67       O:057                                                 O:057    |
|--] [--------] [---------]/[-------------------------------------------------------(L)--|
   637         TT          11                                                    06     |
|[79]     [58]        [172]                                                             |
O:057/06 - ] [ - - File #3 CRYO_REGEN -  107
                File #6 TECH_RUNGS -  16
           -(L)- - File #3 CRYO_REGEN -  96
           -(U)- - File #3 CRYO_REGEN -  125
```

```
Rung #097
|                                                              |
|                       OPEN                                    |
|          CRYO REGEN   CRYO ROUGH                  OPEN PURGE  |
|PURGE 7   7 PULSE     VALVE 12                    VALVE 12    |
|P7        CR7PT       CR12                        NIF12       |
|   B3        T4:67      O:057                       O:057     |
|---] [--------] [--------]/[-------------------------(L)------|
|   637          TT        13                          10      |
|[79]      [58]        [173]                                   |
O:057/10 - -] [- - File #3 CRYO_REGEN -  108
                   File #6 TECH_RUNGS -  16
            -(L)- - File #3 CRYO_REGEN -  97
            -(U)- - File #3 CRYO_REGEN -  126
Rung #098
|                                                              |
|                       OPEN                                    |
|          CRYO REGEN   CRYO ROUGH                  OPEN PURGE  |
|PURGE 8   8 PULSE     VALVE 11                    VALVE 11    |
|P8        CR8PT       CR11                        NIF11       |
|   B3        T4:68      O:057                       O:057     |
|---] [--------] [--------]/[-------------------------(L)------|
|   638          TT        12                          07      |
|[80]      [64]        [174]                                   |
O:057/07 - -] [- - File #3 CRYO_REGEN -  109
                   File #6 TECH_RUNGS -  16
            -(L)- - File #3 CRYO_REGEN -  98
            -(U)- - File #3 CRYO_REGEN -  127
Rung #099
                                                   ENABLE      |
                                                   PURGE       |
|OPEN PURGE                                        HEATER 2    |
|VALVE 2                                           NIH2        |
|NIF2                                                O:007     |
|   O:007                                                      |
|---] [---------------------------------------------( )--------|
|     07                                               04      |
|[88]                                                          |
O:007/04 - -] [- - File #3 CRYO_REGEN -  110
            -( )- - File #3 CRYO_REGEN -  99
Rung #100
|                                                  ENABLE      |
|OPEN PURGE                                        PURGE       |
|VALVE 3                                           HEATER 3    |
|NIF3                                              NIH3        |
|   O:007                                            O:007     |
|---] [---------------------------------------------( )--------|
|     10                                               05      |
|[89]                                                          |
O:007/05 - -] [- - File #3 CRYO_REGEN -  111
            -( )- - File #3 CRYO_REGEN -  100
Rung #101
                                                   ENABLE      |
|OPEN PURGE                                        PURGE       |
|VALVE 4                                           HEATER 4    |
|NIF4                                              NIH4        |
|   O:027                                            O:027     |
|---] [---------------------------------------------( )--------|
|     06                                               03      |
|[91]                                                          |
O:027/03 - -] [- - File #3 CRYO_REGEN -  113
            -( )- - File #3 CRYO_REGEN -  101
```

505

```
Rung #102
|                                                                    ENABLE     |
|OPEN PURGE                                                          PURGE      |
|VALVE 5                                                             HEATER 5   |
|NIF5                                                                NIH5       |
|   0:027                                                             0:027     |
|---] [-------------------------------------------------------------------( )---|
|     07                                                               04       |
|[90]                                                                           |
0:027/04 - ] [ - - File #3 CRYO_REGEN -   112
           -( )- - File #3 CRYO_REGEN -   102
Rung #103
|                                                                    ENABLE     |
|OPEN PURGE                                                          PURGE      |
|VALVE 6                                                             HEATER 6   |
|NIF6                                                                NIH6       |
|   0:027                                                             0:027     |
|---] [-------------------------------------------------------------------( )---|
|     10                                                               05       |
|[92]                                                                           |
0:027/05 - ] [ - - File #3 CRYO_REGEN -   113
           -( )- - File #3 CRYO_REGEN -   103
Rung #104
|                                                                    ENABLE     |
|OPEN PURGE                                                          PURGE      |
|VALVE 7                                                             HEATER 7   |
|NIF7                                                                NIH7       |
|   0:043                                                             0:043     |
|---] [-------------------------------------------------------------------( )---|
|     06                                                               03       |
|[93]                                                                           |
0:043/03 - ] [ - - File #3 CRYO_REGEN -   113
           -( )- - File #3 CRYO_REGEN -   104
Rung #105
|                                                                    ENABLE     |
|OPEN PURGE                                                          PURGE      |
|VALVE 9                                                             HEATER 9   |
|NIF9                                                                NIH9       |
|   0:043                                                             0:043     |
|---] [-------------------------------------------------------------------( )---|
|     10                                                               05       |
|[95]                                                                           |
0:043/05 - ] [ - - File #3 CRYO_REGEN -   115
           -( )- - File #3 CRYO_REGEN -   105
Rung #106
|                                                                    ENABLE     |
|OPEN PURGE                                                          PURGE      |
|VALVE 8                                                             HEATER 8   |
|NIF8                                                                NIH8       |
|   0:043                                                             0:043     |
|---] [-------------------------------------------------------------------( )---|
|     07                                                               04       |
|[94]                                                                           |
0:043/04 - ] [ - - File #3 CRYO_REGEN -   114
           -( )- - File #3 CRYO_REGEN -   106
```

506

```
Rung #107
|                                                                   ENABLE       |
|OPEN PURGE                                                         PURGE        |
|VALVE 10                                                           HEATER 10    |
|NIF10                                                              NIH10        |
|  O:057                                                              O:057      |
|---] [-----------------------------------------------------------------( )------|
|    06                                                                 03       |
|[96]                                                                            |
O:057/03 - ] [ - File #3 CRYO_REGEN - 115
           ( ) - File #3 CRYO_REGEN - 107
Rung #108
|                                                                   ENABLE       |
|OPEN PURGE                                                         PURGE        |
|VALVE 12                                                           HEATER 12    |
|NIF12                                                              NIH12        |
|  O:057                                                              O:057      |
|---] [-----------------------------------------------------------------( )------|
|    10                                                                 05       |
|[97]                                                                            |
O:057/05 - ] [ - File #3 CRYO_REGEN - 115
           ( ) - File #3 CRYO_REGEN - 108
Rung #109
|                                                                   ENABLE       |
|OPEN PURGE                                                         PURGE        |
|VALVE 11                                                           HEATER 11    |
|NIF11                                                              NIH11        |
|  O:057                                                              O:057      |
|---] [-----------------------------------------------------------------( )------|
|    07                                                                 04       |
|[98]                                                                            |
O:057/04 - ] [ - File #3 CRYO_REGEN - 116
           ( ) - File #3 CRYO_REGEN - 109
Rung #110
|         ENABLE   CRYO 2      PURGE                   PURGE TIME               |
|         PURGE    TEMPERATUR  TIMER                   MONITOR                  |
|PURGE 2  HEATER 2 =>290K      DEFEAT                  COMPRESSOR 2             |
|P2       NIH2     CY2TMP290   PG_DEFEAT               PGC2                     |
|  B3      O:007     B3          B3                    +-TON--------------+     |
|--] [------] [------] [---------] [-------------------|TIMER ON DELAY    |-(EN)-|
|  632      04       514         288                   |TIMER:      T4:22 |     |
|[135]     [99]                                        |BASE (SEC):   1.0 |-(DN) |
|                                                      |PRESET:      7200 |     |
|                                                      |ACCUM:          0 |     |
|                                                      +------------------+     |
T4:22.ACC - GEQ - File #3 CRYO_REGEN - 252
T4:22.DN - ] [ - File #3 CRYO_REGEN - 117,128,262
T4:22.TT - ] [ - File #6 TECH_RUNGS - 15
Rung #111
|         ENABLE   CRYO 3      PURGE                   PURGE TIME               |
|         PURGE    TEMPERATUR  TIMER                   MONITOR                  |
|PURGE 3  HEATER 3 =>290K      DEFEAT                  COMPRESSOR 3             |
|P3       NIH3     CY3TMP290   PG_DEFEAT               PGC3                     |
|  B3      O:007     B3          B3                    +-TON--------------+     |
|--] [------] [------] [---------] [-------------------|TIMER ON DELAY    |-(EN)-|
|  633      05       515         288                   |TIMER:      T4:23 |     |
|[136]     [100]                                       |BASE (SEC):   1.0 |-(DN) |
|                                                      |PRESET:      7200 |     |
|                                                      |ACCUM:          0 |     |
|                                                      +------------------+     |
T4:23.ACC - GEQ - File #3 CRYO_REGEN - 253
T4:23.DN - ] [ - File #3 CRYO_REGEN - 118,129,262
```

```
T4:23.TT - -| |- - File #6 TECH_RUNGS -  15
Rung #112
|        ENABLE    CRYO 5     PURGE                                          PURGE TIME          |
|        PURGE     TEMPERATUR TIMER                                          MONITOR             |
|PURGE 4 HEATER 5  =>290K     DEFEAT                                         COMPRESSOR 4        |
|P4      NIH5      CY5TMP290  PG_DEFEAT                                      PGC4                |
|  B3     0:027      B3         B3                                          +-TON----------+     |
|--| |-----| |-------| |--------| |-----------------------------------------+TIMER ON DELAY +-(EN)-|
|  634      04      517        288                                          |TIMER:    T4:24|     |
|[137]    [102]                                                             |BASE (SEC): 1.0+-(DN)|
|                                                                           |PRESET:    7200|     |
|                                                                           |ACCUM:        0|     |
|                                                                           +---------------+     |
T4:24.ACC - GEQ - File #3 CRYO_REGEN -  254
T4:24.DN - -| |- - File #3 CRYO_REGEN -  119,130,262
T4:24.TT - -| |- - File #6 TECH_RUNGS -  15
Rung #113
|         ENABLE     CRYO 4     CRYO 6     CRYO 7     PURGE                  PURGE TIME          |
|         PURGE      TEMPERATUR TEMPERATUR TEMPERATUR TIMER                  MONITOR             |
|PURGE 5  HEATER 4   =>290K     =>290K     =>290K     DEFEAT                 COMPRESSOR 5        |
|P5       NIH4       CY4TMP290  CY6TMP290  CY7TMP290  PG_DEFEAT              PGC5                |
|  B3      0:027       B3         B3         B3         B3                  +-TON----------+     |
|--| |----+--| |--+-----| |--------| |--------| |--------| |---------------+TIMER ON DELAY +-(EN)-|
|  635    |  03   |    516        518        519        288                 |TIMER:    T4:25|     |
|[138]    |[101]  |                                                         |BASE (SEC): 1.0+-(DN)|
|         |       | T4:25.ACC - GEQ - File #3 CRYO_REGEN - 255              |PRESET:    7200|     |
|         |       | T4:25.DN - -| |- - File #3 CRYO_REGEN - 120, 121, 122, 131, 262  |ACCUM:  0|  |
|         |       | T4:25.TT - -| |- - File #6 TECH_RUNGS - 15              +---------------+     |
|         |ENABLE |                                                                              |
|         |PURGE  |                                                                              |
|         |HEATER 6                                                                              |
|         |NIH6   |                                                                              |
|         | 0:027 |                                                                              |
|         +--| |--+                                                                              |
|         |  05   |                                                                              |
|         |[103]  |                                                                              |
|         |ENABLE |                                                                              |
|         |PURGE  |                                                                              |
|         |HEATER 7                                                                              |
|         |NIH7   |                                                                              |
|         | 0:043 |                                                                              |
|         +--| |--+                                                                              |
|            03                                                                                  |
|          [104]                                                                                 |
Rung #114
|        ENABLE    CRYO 8     PURGE                                          PURGE TIME          |
|        PURGE     TEMPERATUR TIMER                                          MONITOR             |
|PURGE 6 HEATER 8  =>290K     DEFEAT                                         COMPRESSOR 6        |
|P6      NIH8      CY8TMP290  PG_DEFEAT                                      PGC6                |
|  B3     0:043      B3         B3                                          +-TON----------+     |
|--| |-----| |-------| |--------| |-----------------------------------------+TIMER ON DELAY +-(EN)-|
|  636      04      520        288                                          |TIMER:    T4:26|     |
|[139]    [106]                                                             |BASE (SEC): 1.0+-(DN)|
|                                                                           |PRESET:    7200|     |
|                                                                           |ACCUM:        0|     |
|                                                                           +---------------+     |
T4:26.ACC - GEQ - File #3 CRYO_REGEN -  256
T4:26.DN - -| |- - File #3 CRYO_REGEN -  123,132,262
T4:26.TT - -| |- - File #6 TECH_RUNGS -  15
```

```
Rung #115
|           ENABLE      CRYO 9      CYRO 10     CRYO 12     PURGE                              PURGE TIME             |
|           PURGE       TEMPERATUR  TEMPERATUR  TEMPERATUR  TIMER                              MONITOR                |
|PURGE 7    HEATER 9    =>290K      =>290K      =>290K      DEFEAT                             COMPRESSOR 7           |
|P7         NIH9        CY9TMP290   CY10TMP290  CY12TMP290  PG_DEFEAT                          PGC7                   |
|  B3        0:043        B3          B3          B3          B3                               +-TON---------------+  |
|--| |-------+--| |---+----| |---------| |---------| |---------| |-----------------------------+TIMER ON DELAY     +-(EN)-|
|   637      |   05   |   521         522         524         288                            |TIMER:       T4:27|   |
|[140]       |[105]   |                                                                      |BASE (SEC):    1.0+-(DN) |
|            |        | T4:27.ACC - GEQ - File #3 CRYO_REGEN - 257                           |PRESET:       7200|   |
|            |        | T4:27.DN - -| |- - File #3 CRYO_REGEN - 124, 125, 126, 133, 262     |ACCUM:           0|   |
|            |        | T4:27.TT - -| |- - File #6 TECH_RUNGS - 15                           +-------------------+   |
|            |ENABLE  |                                                                                              |
|            |PURGE   |                                                                                              |
|            |HEATER 10                                                                                              |
|            |NIH10   |                                                                                              |
|            |  0:057 |                                                                                              |
|            |--| |---|                                                                                              |
|            |   03   |                                                                                              |
|            |[107]   |                                                                                              |
|            |ENABLE  |                                                                                              |
|            |PURGE   |                                                                                              |
|            |HEATER 12                                                                                              |
|            |NIH12   |                                                                                              |
|            |  0:057 |                                                                                              |
|            +--| |---+                                                                                              |
|               05                                                                                                    |
             [108]
Rung #116
|          ENABLE     CRYO 11     PURGE                                                        PURGE TIME             |
|          PURGE      TEMPERATUR  TIMER                                                        MONITOR                |
|PURGE 8   HEATER 11  =>290K      DEFEAT                                                       COMPRESSOR 8           |
|P8        NIH11      CY11TMP290  PG_DEFEAT                                                    PGC8                   |
|  B3       0:057       B3          B3                                                         +-TON---------------+  |
|--| |-------| |--------| |---------| |---------------------------------------------------------+TIMER ON DELAY     +-(EN)-|
|  638       04         523         288                                                        |TIMER:       T4:28|   |
|[141]     [109]                                                                               |BASE (SEC):    1.0+-(DN) |
|                                                                                              |PRESET:       7200|   |
|                                                                                              |ACCUM:           0|   |
|                                                                                              +-------------------+   |

T4:28.ACC - GEQ - File #3 CRYO_REGEN -  258
T4:28.DN - -| |- - File #3 CRYO_REGEN -  127,134,262
T4:28.TT - -| |- - File #6 TECH_RUNGS -  15
```

509

```
Rung #117
            PURGE TIME
            MONITOR
 CRYO 2     CRYO 2                                          OPEN PURGE
 TEMPERATUR 120 MIN.    BLOWER 2                            VALVE 2
 =>290K     DONE        ENABLED                             NIF2
 CY2TMP290  PGC2        BL2                                   O:007
    B3        T4:22     O:027
|---| |-------| |--------| |---------------------------------(U)---|
    514        DN        01                                     07
             [110]     [2:74]
                                  O:007/07 - -| |- - File #3 CRYO_REGEN - 99
                                                     File #6 TECH_RUNGS - 16
                                             -(L)- - File #3 CRYO_REGEN - 88
 |COMPRESSOR
 |2 REGEN-
 |ERATION
 |PROGRAM
 |CYRGN2
 |  B3
 |--|/|------------------|
    322
 [34]
Rung #118
            PURGE TIME
            MONITOR
 CRYO 3     CRYO 3                                          OPEN PURGE
 TEMPERATUR 120 MIN.    BLOWER 2                            VALVE 3
 =>290K     DONE        ENABLED                             NIF3
 CY3TMP290  PGC3        BL2                                   O:007
    B3        T4:23     O:027
|---| |-------| |--------| |---------------------------------(U)---|
    515        DN        01                                     10
             [111]     [2:74]
                                  O:007/10 - -| |- - File #3 CRYO_REGEN - 100
                                                     File #6 TECH_RUNGS - 16
                                             -(L)- - File #3 CRYO_REGEN - 89
 |COMPRESSOR
 |3 REGEN-
 |ERATION
 |PROGRAM
 |CYRGN3
 |  B3
 |--|/|------------------|
    323
 [38]
```

510

```
Rung #119
|             PURGE TIME
|             MONITOR
| CRYO 5      CRYO 4
| TEMPERATUR  120 MIN     BLOWER 2                                        OPEN PURGE
| =>290K      DONE        ENABLED                                         VALVE 5
| CY5TMP290   PGC4        BL2                                             NIF5
|    B3          T4:24      O:027                                           O:027
|-+---] [---------] [--------] [---+--------------------------------------(U)---|
| |    517         DN          01  |                                        07
| |               [112]      [2:74]|
| |                                | O:027/07 - ] [ - File #3 CRYO_REGEN - 102
| |                                |                  File #6 TECH_RUNGS - 16
| |COMPRESSOR                      |          -(L)- - File #3 CRYO_REGEN - 90
| |4 REGEN-                        |
| |ERATION                         |
| |PROGRAM                         |
| |CYRGN4                          |
| |    B3                          |
| +---]/[--------------------------+
|      324
| [42]
```

```
Rung #120
|             PURGE TIME
|             MONITOR
| CRYO 4      CRYO 5
| TEMPERATUR  120 MIN     BLOWER 2                                        OPEN PURGE
| =>290K      DONE        ENABLED                                         VALVE 4
| CY4TMP290   PGC5        BL2                                             NIF4
|    B3          T4:25      O:027                                           O:027
|-+---] [---------] [--------] [---+--------------------------------------(U)---|
| |    516         DN          01  |                                        06
| |               [113]      [2:74]|
| |                                | O:027/06 - ] [ - File #3 CRYO_REGEN - 101
| |                                |                  File #6 TECH_RUNGS - 16
| |COMPRESSOR                      |          -(L)- - File #3 CRYO_REGEN - 91
| |5 REGEN-                        |
| |ERATION                         |
| |PROGRAM                         |
| |CYRGN5                          |
| |    B3                          |
| +---]/[--------------------------+
|      325
| [46]
```

511

```
Rung #121
|            PURGE TIME                                                                    |
|            MONITOR                                                                       |
| CRYO 6     CRYO 5                                                                        |
| TEMPERATUR 120 MIN     BLOWER 2                                              OPEN PURGE  |
| =>290K     DONE        ENABLED                                               VALVE 6     |
| CY6TMP290  PGC5        BL2                                                   NIF6        |
|     B3        T4:25      O:027                                                 O:027     |
|-+---] [---------] [--------] [---+------------------------------------------------(U)----|
| |   518         DN         01    |                                                 10    |
| |            [113]      [2:74]   |                                                       |
| |                                | O:027/10 - ] [ - File #3 CRYO_REGEN - 103             |
| |                                |                  File #6 TECH_RUNGS - 16              |
| |COMPRESSOR                      |              -(L)- - File #3 CRYO_REGEN - 92          |
| |5 REGEN-                        |                                                       |
| |ERATION                         |                                                       |
| |PROGRAM                         |                                                       |
| |CYRGN5                          |                                                       |
| |    B3                          |                                                       |
| +---]/[--------------------------+                                                       |
|     325                                                                                  |
| [46]                                                                                     |
Rung #122
|            PURGE TIME                                                                    |
|            MONITOR                                                                       |
| CRYO 7     CRYO 5                                                                        |
| TEMPERATUR 120 MIN     BLOWER 2                                              OPEN PURGE  |
|  >290K     DONE        ENABLED                                               VALVE 7     |
| CY7TMP290  PGC5        BL2                                                   NIF7        |
|     B3        T4:25      O:027                                                 O:043     |
|-+---] [---------] [--------] [---+------------------------------------------------(U)----|
| |   519         DN         01    |                                                 06    |
| |            [113]      [2:74]   |                                                       |
| |                                | O:043/06 - ] [ - File #3 CRYO_REGEN - 104             |
| |                                |                  File #6 TECH_RUNGS - 16              |
| |COMPRESSOR                      |              -(L)- - File #3 CRYO_REGEN - 93          |
| |5 REGEN-                        |                                                       |
| |ERATION                         |                                                       |
| |PROGRAM                         |                                                       |
| |CYRGN5                          |                                                       |
| |    B3                          |                                                       |
| +---]/[--------------------------+                                                       |
|     325                                                                                  |
| [46]                                                                                     |
```

512

```
Rung #123
|                  PURGE TIME
|                  MONITOR
| CRYO 8           CRYO 6                                                        OPEN PURGE
| TEMPERATUR       120 MIN      BLOWER 2                                         VALVE 8
| =>290K           DONE         ENABLED                                          NIF8
| CY8TMP290        PGC6         BL2                                                0:043
|     B3            T4:26       0:027                                              
|-+---] [-----------] [----------] [---+-------------------------------------------(U)---|
| |   520           DN           01    |                                           07
| |                [114]        [2:74] |
| |                                    | 0:043/07 - ] [ - File #3 CRYO_REGEN - 106
| |                                    |                  File #6 TECH_RUNGS - 16
| |COMPRESSOR                          |           -(L)- - File #3 CRYO_REGEN - 94
| |6 REGEN-                            |
| |ERATION                             |
| |PROGRAM                             |
| |CYRGN6                              |
| |   B3                               |
| +---]/[------------------------------+
|     326
| [53]
Rung #124
|                  PURGE TIME
|                  MONITOR
| CRYO 9           CRYO 7                                                        OPEN PURGE
| TEMPERATUR       120 MIN      BLOWER 2                                         VALVE 9
|  >290K           DONE         ENABLED                                          NIF9
| CY9TMP290        PGC7         BL2                                                0:043
|     B3            T4:27       0:027
|-+---] [-----------] [----------] [---+-------------------------------------------(U)---|
| |   521           DN           01    |                                           10
| |                [115]        [2:74] |
| |                                    | 0:043/10 - ] [ - File #3 CRYO_REGEN - 105
| |                                    |                  File #6 TECH_RUNGS - 16
| |COMPRESSOR                          |           -(L)- - File #3 CRYO_REGEN - 95
| |7 REGEN-                            |
| |ERATION                             |
| |PROGRAM                             |
| |CYRGN7                              |
| |   B3                               |
| +---]/[------------------------------+
|     327
| [57]
```

513

Rung #125

```
|             PURGE TIME                                                                         |
|             MONITOR                                                                            |
| CYRO 10     CRYO 7                                                                             |
| TEMPERATUR  120 MIN     BLOWER 2                                                  OPEN PURGE   |
| =>290K      DONE        ENABLED                                                   VALVE 10     |
| CY10TMP290  PGC7        BL2                                                       NIF10        |
|     B3          T4:27      O:027                                                   O:057      |
|-+---] [---------] [---------] [----+----------------------------------------------------(U)----|
| |   522          DN         01     |                                                  06       |
| |              [115]      [2:74]   |                                                           |
| |                                  | O:057/06 - ] [ - File #3 CRYO_REGEN - 107                 |
| |                                  |                  File #6 TECH_RUNGS - 16                  |
| |COMPRESSOR                        |            -(L)- - File #3 CRYO_REGEN - 96                |
| |7 REGEN-                          |                                                           |
| |ERATION                           |                                                           |
| |PROGRAM                           |                                                           |
| |CYRGN7                            |                                                           |
| |    B3                            |                                                           |
| +---]/[----------------------------+                                                           |
|     327                                                                                        |
|  [57]                                                                                          |
```

Rung #126

```
|             PURGE TIME                                                                         |
|             MONITOR                                                                            |
| CRYO 12     CRYO 7                                                                             |
| TEMPERATUR  120 MIN     BLOWER 2                                                  OPEN PURGE   |
|  >290K      DONE        ENABLED                                                   VALVE 12     |
| CY12TMP290  PGC7        BL2                                                       NIF12        |
|     B3          T4:27      O:027                                                   O:057      |
|-+---] [---------] [---------] [----+----------------------------------------------------(U)----|
| |   524          DN         01     |                                                  10       |
| |              [115]      [2:74]   |                                                           |
| |                                  | O:057/10 - ] [ - File #3 CRYO_REGEN - 108                 |
| |                                  |                  File #6 TECH_RUNGS - 16                  |
| |COMPRESSOR                        |            -(L)- - File #3 CRYO_REGEN - 97                |
| |7 REGEN-                          |                                                           |
| |ERATION                           |                                                           |
| |PROGRAM                           |                                                           |
| |CYRGN7                            |                                                           |
| |    B3                            |                                                           |
| +---]/[----------------------------+                                                           |
|     327                                                                                        |
|  [57]                                                                                          |
```

```
Rung #127
|             PURGE TIME
|             MONITOR
| CRYO 11     CRYO 8                                                 OPEN PURGE
| TEMPERATUR  120 MIN     BLOWER 2                                   VALVE 11
| =>290K      DONE        ENABLED                                    NIF11
| CY11TMP290  PGC8        BL2                                         O:057
|     B3          T4:28      O:027
|-+---] [---------] [--------] [--+----------------------------------(U)---|
| |   523          DN         01  |                                   07
| |               [116]     [2:74]|
| |                               | O:057/07 - ] [ - - File #3 CRYO_REGEN - 109
| |                               |                    File #6 TECH_RUNGS - 16
| |COMPRESSOR                     |          -(L)- - File #3 CRYO_REGEN - 98
| |8 REGEN-                       |
| |ERATION                        |
| |PROGRAM                        |
| |CYRGN8                         |
| |   B3                          |
| +---]/[-------------------------+
|     328
|  [63]
Rung #128
|         PURGE TIME
|         MONITOR
|         CRYO 2     CRYO 2                                            ROUGHING
|         120 MIN.   TEMPERATUR  BLOWER 2                              AND ROR 2
|  GE 2   DONE       =>290K      ENABLED                               R&ROR2
|P2       PGC2       CY2TMP290   BL2                                     B3
|  B3        T4:22      B3          O:027
|---] [--------] [--------] [---------] [---------------------------------(L)---|
|  632        DN         514          01                                  642
|[135]    [110]                     [2:74]
B3/642 - ] [ - - File #3 CRYO_REGEN -  135,164,175,176,189,196,203
                 File #6 TECH_RUNGS -  17
       -(L)- - File #3 CRYO_REGEN -  128
       -(U)- - File #3 CRYO_REGEN -  210
Rung #129
|         PURGE TIME
|         MONITOR
|         CRYO 3     CRYO 3                                            ROUGHING
|         120 MIN.   TEMPERATUR  BLOWER 2                              AND ROR 3
|PURGE 3  DONE       =>290K      ENABLED                               R&ROR3
|P3       PGC3       CY3TMP290   BL2                                     B3
|  B3        T4:23      B3          O:027
|---] [--------] [--------] [---------] [---------------------------------(L)---|
|  633        DN         515          01                                  643
|[136]    [111]                     [2:74]
B3/643 - ] [ - - File #3 CRYO_REGEN -  136,165,177,178,190,197,204
                 File #6 TECH_RUNGS -  17
       -(L)- - File #3 CRYO_REGEN -  129
       -(U)- - File #3 CRYO_REGEN -  211
Rung #130
|         PURGE TIME
|         MONITOR
|         CRYO 4     CRYO 5                                            ROUGHING
|         120 MIN    TEMPERATUR  BLOWER 2                              AND ROR 4
|PURGE 4  DONE       =>290K      ENABLED                               R&ROR4
|P4       PGC4       CY5TMP290   BL2                                     B3
|  B3        T4:24      B3          O:027
|---] [--------] [--------] [---------] [---------------------------------(L)---|
|  634        DN         517          01                                  644
|[137]    [112]                     [2:74]
```

```
B3/644 - -| |- - File #3 CRYO_REGEN -  137,166,179,180,191,198,205
                 File #6 TECH_RUNGS -  17
       -(L)- - File #3 CRYO_REGEN -  130
       -(U)- - File #3 CRYO_REGEN -  212
Rung #131
|       PURGE TIME                                                                      |
|       MONITOR                                                                         |
|       CRYO 5    CRYO 4     CRYO 6     CRYO 7                                          |
|       120 MIN   TEMPERATUR TEMPERATUR TEMPERATUR BLOWER 2                  ROUGHING   |
|PURGE 5 DONE     =>290K     =>290K     =>290K     ENABLED                   AND ROR 5  |
|P5     PGC5      CY4TMP290  CY6TMP290  CY7TMP290  BL2                       R&ROR5     |
|  B3     T4:25     B3         B3         B3        O:027                       B3      |
|--| |-----| |------| |--------| |--------| |--------| |------------------------(L)-----|
|  635     DN       516        518        519        01                         645     |
|[138]   [113]                                      [2:74]
B3/645 - -| |- - File #3 CRYO_REGEN -  138,167,168,169,181,182,192,199,206
                 File #6 TECH_RUNGS -  17
       -(L)- - File #3 CRYO_REGEN -  131
       -(U)- - File #3 CRYO_REGEN -  213
Rung #132
|       PURGE TIME                                                                      |
|       MONITOR                                                                         |
|       CRYO 6    CRYO 8                                                                |
|       120 MIN   TEMPERATUR BLOWER 2                                        ROUGHING   |
|PURGE 6 DONE     =>290K     ENABLED                                        AND ROR 6  |
|P6     PGC6      CY8TMP290  BL2                                            R&ROR6     |
|  B3     T4:26     B3        O:027                                            B3      |
|--| |-----| |------| |-------| |---------------------------------------------(L)-----|
|  636     DN       520        01                                             646     |
|[139]   [114]               [2:74]
B3/646 - -| |- - File #3 CRYO_REGEN -  139,170,183,184,193,200,207
                 File #6 TECH_RUNGS -  17
       -(L)- - File #3 CRYO_REGEN -  132
       -(U)- - File #3 CRYO_REGEN -  214
Rung #133
|       PURGE TIME                                                                      |
|       MONITOR                                                                         |
|       CRYO 7    CRYO 9     CYRO 10    CRYO 12                                         |
|       120 MIN   TEMPERATUR TEMPERATUR TEMPERATUR BLOWER 2                  ROUGHING   |
|PURGE 7 DONE     =>290K     =>290K     =>290K     ENABLED                   AND ROR 7  |
|P7     PGC7      CY9TMP290  CY10TMP290 CY12TMP290 BL2                       R&ROR7     |
|  B3     T4:27     B3         B3         B3        O:027                       B3      |
|--| |-----| |------| |--------| |--------| |--------| |------------------------(L)-----|
|  637     DN       521        522        524        01                         647     |
|[140]   [115]                                      [2:74]
B3/647 - -| |- - File #3 CRYO_REGEN -  140,171,172,173,185,186,194,201,208
                 File #6 TECH_RUNGS -  17
       -(L)- - File #3 CRYO_REGEN -  133
       -(U)- - File #3 CRYO_REGEN -  215
 ung #134
|       PURGE TIME                                                                      |
|       MONITOR                                                                         |
|       CRYO 8    CRYO 11                                                               |
|       120 MIN   TEMPERATUR BLOWER 2                                        ROUGHING   |
|PURGE 8 DONE     =>290K     ENABLED                                        AND ROR 8  |
|P8     PGC8      CY11TMP290 BL2                                            R&ROR8     |
|  B3     T4:28     B3        O:027                                            B3      |
|--| |-----| |------| |-------| |---------------------------------------------(L)-----|
|  638     DN       523        01                                             648     |
|[141]   [116]               [2:74]
B3/648 - -| |- - File #3 CRYO_REGEN -  141,174,187,188,195,202,209
                 File #6 TECH_RUNGS -  17
```

516

```
        -(L)- - File #3 CRYO_REGEN -  134
        -(U)- - File #3 CRYO_REGEN -  216
Rung #135
|                                CRYO 2
|  ROUGHING    BLOWER 2   TEMPERATUR                                                    PURGE 2
|  AND ROR 2   ENABLED    =>290K                                                        P2
|  R&ROR2      BL2        CY2TMP290                                                        B3
|      B3        O:027       B3
|----] [--------] [--------] [-----------------------------------------------------------(U)----|
| |    642         01         514                                                          632
| |[128]      [2:74]           |
| |                            | B3/632 - -] [- - File #3 CRYO_REGEN - 88, 110, 128
| |                            |                  File #6 TECH_RUNGS - 15
| |                            |          -(L)- - File #3 CRYO_REGEN - 74
| |COMPRESSOR                  |
| |2 REGEN-                    |
| |ERATION                     |
| |PROGRAM                     |
| |CYRGN2                      |
| |     B3                     |
| |----]/[---------------------|
|      322
| [34]
Rung #136
|                                CRYO 3
|  ROUGHING    BLOWER 2   TEMPERATUR                                                    PURGE 3
|  AND ROR 3   ENABLED    =>290K                                                        P3
|  R&ROR3      BL2        CY3TMP290                                                        B3
|      B3        O:027       B3
|----] [--------] [--------] [-----------------------------------------------------------(U)----|
| |    643         01         515                                                          633
| |[129]      [2:74]           |
| |                            | B3/633 - -] [- - File #3 CRYO_REGEN - 89, 111, 129
| |                            |                  File #6 TECH_RUNGS - 15
| |                            |          -(L)- - File #3 CRYO_REGEN - 75
| |COMPRESSOR                  |
| |3 REGEN-                    |
| |ERATION                     |
| |PROGRAM                     |
| |CYRGN3                      |
| |     B3                     |
| |----]/[---------------------|
|      323
| [38]
Rung #137
|                                CRYO 5
|  ROUGHING    BLOWER 2   TEMPERATUR                                                    PURGE 4
|  AND ROR 4   ENABLED    =>290K                                                        P4
|  R&ROR4      BL2        CY5TMP290                                                        B3
|      B3        O:027       B3
|----] [--------] [--------] [-----------------------------------------------------------(U)----|
| |    644         01         517                                                          634
| |[130]      [2:74]           |
| |                            | B3/634 - -] [- - File #3 CRYO_REGEN - 90, 112, 130
| |                            |                  File #6 TECH_RUNGS - 15
| |                            |          -(L)- - File #3 CRYO_REGEN - 76
| |COMPRESSOR                  |
| |4 REGEN-                    |
| |ERATION                     |
| |PROGRAM                     |
| |CYRGN4                      |
| |     B3                     |
| |----]/[---------------------|
|      324
| [42]
```

517

Rung #138

```
|                              CRYO 4      CRYO 6      CRYO 7                                   |
| ROUGHING     BLOWER 2   TEMPERATUR  TEMPERATUR  TEMPERATUR                                   |
| AND ROR 5    ENABLED    =>290K      =>290K      =>290K                        PURGE 5         |
| R&ROR5       BL2        CY4TMP290   CY6TMP290   CY7TMP290                     P5              |
|     B3       0:027         B3          B3          B3                               B3        |
|-+---] [-------] [----------] [----------] [----------] [-----+---------------------------(U)---|
| |   645       01          516         518         519        |                         635    |
| |[131]     [2:74]                                            |                                |
| |                                                            | B3/635 - ] [ - File #3 CRYO_REGEN - 91, 92, 93, 113, 131
| |                                                            |                File #6 TECH_RUNGS - 15
| |COMPRESSOR                                                  |        -(L)- - File #3 CRYO_REGEN - 77
| |5 REGEN-                                                    |                                |
| |ERATION                                                     |                                |
| |PROGRAM                                                     |                                |
| |CYRGN5                                                      |                                |
| |    B3                                                      |                                |
| +---]/[------------------------------------------------------+                                |
|     325                                                                                       |
| [46]                                                                                          |
```

Rung #139

```
|                         CRYO 8                                                               |
| ROUGHING     BLOWER 2   TEMPERATUR                                                           |
| AND ROR 6    ENABLED    =>290K                                              PURGE 6         |
| R&ROR6       BL2        CY8TMP290                                           P6              |
|     B3       0:027         B3                                                      B3        |
|-+---] [-------] [----------] [-----+-------------------------------------------------(U)-----|
| |   646       01          520      |                                                 636     |
| |[132]     [2:74]                  |                                                          |
| |                                  | B3/636 - ] [ - File #3 CRYO_REGEN - 94, 114, 132        |
| |                                  |                File #6 TECH_RUNGS - 15                    |
| |COMPRESSOR                        |        -(L)- - File #3 CRYO_REGEN - 78                    |
| |6 REGEN-                          |                                                          |
| |ERATION                           |                                                          |
| |PROGRAM                           |                                                          |
| |CYRGN6                            |                                                          |
| |    B3                            |                                                          |
| +---]/[----------------------------+                                                          |
|     326                                                                                       |
| [53]                                                                                          |
```

Rung #140

```
|                              CRYO 9      CYRO 10     CRYO 12                                  |
| ROUGHING     BLOWER 2   TEMPERATUR  TEMPERATUR  TEMPERATUR                                   |
| AND ROR 7    ENABLED    =>290K      =>290K      =>290K                        PURGE 7         |
| R&ROR7       BL2        CY9TMP290   CY10TMP290  CY12TMP290                    P7              |
|     B3       0:027         B3          B3          B3                               B3        |
|-+---] [-------] [----------] [----------] [----------] [-----+---------------------------(U)---|
| |   647       01          521         522         524        |                         637    |
| |[133]     [2:74]                                            |                                |
| |                                                            | B3/637 - ] [ - File #3 CRYO_REGEN - 95, 96, 97, 115, 133
| |                                                            |                File #6 TECH_RUNGS - 15
| |COMPRESSOR                                                  |        -(L)- - File #3 CRYO_REGEN - 79
| |7 REGEN-                                                    |                                |
| |ERATION                                                     |                                |
| |PROGRAM                                                     |                                |
| |CYRGN7                                                      |                                |
| |    B3                                                      |                                |
| +---]/[------------------------------------------------------+                                |
|     327                                                                                       |
| [57]                                                                                          |
```

518

```
Rung #141
                                     CRYO 11
  ROUGHING      BLOWER 2    TEMPERATUR                                                    PURGE 8
  AND ROR 8     ENABLED     =>290K                                                        P8
  R&ROR8        BL2         CY11TMP290                                                    B3
     B3           O:027        B3                                                         -(U)-
  ---] [--------] [----------] [----+-----------------------------------------------------
    648             01          523 |                                                     638
  [134]          [2:74]             |
                                    | B3/638 - -] [- - File #3 CRYO_REGEN - 98, 116, 134
                                    |                  File #6 TECH_RUNGS - 15
  COMPRESSOR                        |          -(L)- - File #3 CRYO_REGEN - 80
  8 REGEN-                          |
  ERATION                           |
  PROGRAM                           |
  CYRGN8                            |
     B3                             |
  ---]/[----------------------------+
    328
  [63]

Rung #142
MANUAL
CONTROL                                                                     MANUAL CRYO
CRYO ROUGH                                                                  ROUGH 2
VALVE 2                                                                     OPEN
OPEN                                                                        MCR2OP
M-CR2-1                                                                       N7:33
   N7:12                                                                   +--(L)--+
---] [----------------------------------------------------------------------+       +
    10                                                                      |   10  |
[2:3]                                                                       |       |
N7:33/10 - -] [- - File #3 CRYO_REGEN - 164                                 |MANUAL CRYO
           -(U)- - File #3 CRYO_REGEN - 143                                 |ROUGH 2
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                                 |CLOSE
N7:28/10 - -(L)- - File #3 CRYO_REGEN - 143                                 |MCR2CL
_F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                                 |  N7:28
                                                                            +--(U)--+
                                                                                10

Rung #143
  MANUAL
  CONTROL                                                                   MANUAL CRYO
  CLOSE CRYO                                                                ROUGH 2
  ROUGH                                                                     OPEN
  VALVE 2                                                                   MCR2OP
  M-CR2-O                                                                     N7:33
     N7:7                                                                  +--(U)--+
  ---] [-------------------+-----------------------------------------------+       +
      10                   |                                               |   10  |
  [2:3]                    |                                               |       |
                           | N7:33/10 - -] [- - File #3 CRYO_REGEN - 164   |MANUAL CRYO
                           |            -(L)- - File #3 CRYO_REGEN - 142   |ROUGH 2
  COMPRESSOR               | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2   |CLOSE
  2 REGEN-     CRYO 2      | N7:28/10 - -(U)- - File #3 CRYO_REGEN - 142   |MCR2CL
  ERATION      TEMPERATUR  | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2   |  N7:28
  PROGRAM      =<20K       |                                               +--(L)--+
  CYRGN2       CY2TMP20    |                                                   10
     B3           B3       |
  ---]/[--------] [--------+
    322          502
  [238]
```

519

```
Rung #144
|MANUAL
|CONTROL
|CRYO ROUGH                                                      MANUAL CRYO
|VALVE 3                                                         ROUGH 3
|OPEN                                                            OPEN
|N-CR3-1                                                         MCR3OP
|  N7:12                                                            N7:33
|---] [-------------------------------------------------------------(L)-
|    11                                                                11
|[2:3]                                                           |MANUAL CRYO
| N7:33/11 - -] [- - File #3 CRYO_REGEN - 165                     |ROUGH 3
|            -(U)- - File #3 CRYO_REGEN - 145                     |CLOSE
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                     |MCR3CL
| N7:28/11 - -(L)- - File #3 CRYO_REGEN - 145                     |   N7:28
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                     +---(U)---
|                                                                      11

Rung #145
| MANUAL
| CONTROL
| CLOSE CRYO                                                     MANUAL CRYO
| ROUGH                                                          ROUGH 3
| VALVE 3                                                        OPEN
| N-CR3-0                                                        MCR3OP
|     N7:7                                                          N7:33
|-------] [---------+-----------------------------------------------(U)-
|        11         |                                                  11
| |[2:3]            | N7:33/11 - -] [- - File #3 CRYO_REGEN - 165
| |                 |             -(L)- - File #3 CRYO_REGEN - 144   |MANUAL CRYO
| |COMPRESSOR       | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2    |ROUGH 3
| |3 REGEN-   CRYO 3| N7:28/11 - -(U)- - File #3 CRYO_REGEN - 144    |CLOSE
| |ERATION  TEMPERATUR _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2   |MCR3CL
| |PROGRAM    =<20K |                                                |   N7:28
| |CYRGN3    CY3TMP20                                                +---(L)---
| |   B3        B3  |                                                     11
| +---]/[------] [--+
|    323       503
|  [239]

Rung #146
|MANUAL
|CONTROL
|CRYO ROUGH                                                      MANUAL CRYO
|VALVE 4                                                         ROUGH 4
|OPEN                                                            OPEN
|N-CR4-1                                                         MCR4OP
|  N7:12                                                            N7:33
|---] [-------------------------------------------------------------(L)-
|    12                                                                12
|[2:3]                                                           |MANUAL CRYO
| N7:33/12 - -] [- - File #3 CRYO_REGEN - 167                     |ROUGH 4
|            -(U)- - File #3 CRYO_REGEN - 147                     |CLOSE
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                     |MCR4CL
| N7:28/12 - -(L)- - File #3 CRYO_REGEN - 147                     |   N7:28
| _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2                     +---(U)---
|                                                                      12
```

520

```
Rung #147
| MANUAL
| CONTROL                                                             MANUAL CRYO
| CLOSE CRYO                                                          ROUGH 4
| ROUGH                                                               OPEN
| VALVE 4                                                             MCR4OP
| M-CR4-O                                                                N7:33
|      N7:7                                                            --(U)--
|----| |----------------------------------------------------------------+------+
|      12                                                                 12
| [2:3]
|          | N7:33/12 - -| |- - File #3 CRYO_REGEN - 167               |MANUAL CRYO
|          |            -(L)- - File #3 CRYO_REGEN - 146               |ROUGH 4
| COMPRESSOR | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2             |CLOSE
| 5 REGEN-    CRYO 4   | N7:28/12 - -(U)- - File #3 CRYO_REGEN - 146   |MCR4CL
| ERATION     TEMPERATUR | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2 |   N7:28
| PROGRAM     =<20K                                                    +--(L)--
| CYRGN5      CY4TMP20                                                     12
|     B3         B3
|----|/|--------| |----
|    325         504
 [241]
Rung #148
|MANUAL                                                               MANUAL CRYO
|CONTROL                                                              ROUGH 5
|CRYO ROUGH                                                           OPEN
  OPEN                                                                MCR5OP
|..-CR5-1                                                                N7:33
|   N7:12                                                              --(L)--
|----| |----------------------------------------------------------------+------+
|     13                                                                   13
|[2:3]
| N7:33/13 - -| |- - File #3 CRYO_REGEN - 166                         |MANUAL CRYO
|           -(U)- - File #3 CRYO_REGEN - 149                          |ROUGH 5
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                         |CLOSE
| N7:28/13 - -(L)- - File #3 CRYO_REGEN - 149                         |MCR5CL
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                         |   N7:28
|                                                                     +--(U)--
|                                                                          13
Rung #149
| MANUAL
| CONTROL                                                             MANUAL CRYO
| CLOSE CRYO                                                          ROUGH 5
| ROUGH                                                               OPEN
| VALVE 5                                                             MCR5OP
| M-CR5-O                                                                N7:33
|      N7:7                                                            --(U)--
|----| |----------------------------------------------------------------+------+
|      13                                                                 13
| [2:3]
|          | N7:33/13 - -| |- - File #3 CRYO_REGEN - 166               |MANUAL CRYO
|          |            -(L)- - File #3 CRYO_REGEN - 148               |ROUGH 5
| COMPRESSOR | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2             |CLOSE
| 4 REGEN-    CRYO 5   | N7:28/13 - -(U)- - File #3 CRYO_REGEN - 148   |MCR5CL
| ERATION     TEMPERATUR | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2 |   N7:28
| PROGRAM     =<20K                                                    +--(L)--
| CYRGN4      CY5TMP20                                                     13
|     B3         B3
|----|/|--------| |----
|    324         505
 [240]
```

521

```
Rung #150
|MANUAL
|CONTROL
|CRYO ROUGH                                                     MANUAL CRYO
|VALVE 6                                                        ROUGH 6
|OPEN                                                           OPEN
|M-CR6-1                                                        MCR6OP
|  N7:12                                                           N7:33
|---] [--------------------------------------------------------+----(L)----
|    14                                                         |    14
|[2:3]                                                          |
| N7:33/14 - ] [ - File #3 CRYO_REGEN - 168                     |MANUAL CRYO
|            -(U)- - File #3 CRYO_REGEN - 151                   |ROUGH 6
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                   |CLOSE
| N7:28/14 - -(L)- - File #3 CRYO_REGEN - 151                   |MCR6CL
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                   |   N7:28
|                                                               +----(U)----
|                                                                    14

Rung #151
|  MANUAL
|  CONTROL
|  CLOSE CRYO                                                   MANUAL CRYO
|  ROUGH                                                        ROUGH 6
|  VALVE 6                                                      OPEN
|  M-CR6-O                                                      MCR6OP
|      N7:7                                                        N7:33
|--+---] [---------------+-------------------------------------+----(U)----
|  |     14              |                                     |    14
|  |[2:3]                |                                     |
|  |                     | N7:33/14 - ] [ - File #3 CRYO_REGEN - 168
|  |                     |            -(L)- - File #3 CRYO_REGEN - 150
|  |COMPRESSOR           | _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2
|  |S REGEN-    CRYO 6   | N7:28/14 - -(U)- - File #3 CRYO_REGEN - 150
|  |ERATION     TEMPERATUR| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2
|  |PROGRAM     =<20K    |                                     |MANUAL CRYO
|  |CYRGNS      CY6TMP20 |                                     |ROUGH 6
|  |   B3          B3    |                                     |CLOSE
|  +---]/[--------] [----+                                     |MCR6CL
|      325         506                                         |   N7:28
| [241]                                                        +----(L)----
|                                                                   14

Rung #152
|MANUAL
|CONTROL
|CRYO ROUGH                                                     MANUAL CRYO
|VALVE 7                                                        ROUGH 7
|OPEN                                                           OPEN
|M-CR7-1                                                        MCR7OP
|  N7:12                                                           N7:33
|---] [--------------------------------------------------------+----(L)----
|    15                                                         |    15
|[2:3]                                                          |
| N7:33/15 - ] [ - File #3 CRYO_REGEN - 169                     |MANUAL CRYO
|            -(U)- - File #3 CRYO_REGEN - 153                   |ROUGH 7
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                   |CLOSE
| N7:28/15 - -(L)- - File #3 CRYO_REGEN - 153                   |MCR7CL
| _F:N7:21l%21 - BTW - File #2 MAIN_PRGRM - 2                   |   N7:28
|                                                               +----(U)----
|                                                                    15
```

522

```
Rung #153
| MANUAL
| CONTROL
| CLOSE CRYO                                                    MANUAL CRYO
| ROUGH                                                         ROUGH 7
| VALVE 7                                                       OPEN
| M-CR7-0                                                       MCR7OP
|      N7:7                                                        N7:33
|----| |------------------------------------------------------------(U)---|
|      15                                                            15
| [2:3]
|                    N7:33/15 - -| |- - File #3 CRYO_REGEN - 169
|                               -(L)- - File #3 CRYO_REGEN - 152   MANUAL CRYO
| COMPRESSOR         _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2   ROUGH 7
| 5 REGEN-   CRYO 7  N7:28/15 - -(U)- - File #3 CRYO_REGEN - 152  CLOSE
| ERATION    TEMPERATUR _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2 MCR7CL
| PROGRAM    =<20K                                                    N7:28
| CYRGN5     CY7TMP20                                              ---(L)---
|   B3         B3                                                     15
|---|/|--------| |
|  325         507
| [241]
Rung #154
|MANUAL
|CONTROL
|CRYO ROUGH                                                     MANUAL CRYO
|VALVE 8                                                        ROUGH 8
 OPEN                                                           OPEN
|M-CR8-1                                                        MCR8OP
|   N7:13                                                          N7:34
|----| |------------------------------------------------------------(L)---|
|     0                                                              0
|[2:3]
| N7:34/0 - -| |- - File #3 CRYO_REGEN - 170                    MANUAL CRYO
|            -(U)- - File #3 CRYO_REGEN - 155                   ROUGH 8
| _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                   CLOSE
| N7:29/0 - -(L)- - File #3 CRYO_REGEN - 155                    MCR8CL
| _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                      N7:29
|                                                                ---(U)---
|                                                                    0
Rung #155
| MANUAL
| CONTROL
| CLOSE CRYO                                                    MANUAL CRYO
| ROUGH                                                         ROUGH 8
| VALVE 8                                                       OPEN
| M-CR8-0                                                       MCR8OP
|      N7:8                                                        N7:34
|----| |------------------------------------------------------------(U)---|
|      0                                                             0
| [2:3]
|                    N7:34/0 - -| |- - File #3 CRYO_REGEN - 170
|                              -(L)- - File #3 CRYO_REGEN - 154    MANUAL CRYO
| COMPRESSOR         _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2   ROUGH 8
| 6 REGEN-   CRYO 8  N7:29/0 - -(U)- - File #3 CRYO_REGEN - 154   CLOSE
| ERATION    TEMPERATUR _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2 MCR8CL
| PROGRAM    =<20K                                                    N7:29
| CYRGN6     CY8TMP20                                              ---(L)---
|   B3         B3                                                     0
|---|/|--------| |
|  326         508
| [242]
```

```
Rung #156
|MANUAL
|CONTROL
|CRYO ROUGH                                                          MANUAL CRYO
|VALVE 9                                                             ROUGH 9
|OPEN                                                                OPEN
|M-CR9-1                                                             MCR9OP
|  N7:13                                                               N7:34
|---] [-------------------------------------------------------------+---(L)---
|    1                                                              |    1
|[2:3]                                                              |
| N7:34/1 - -] [- - File #3 CRYO_REGEN - 171                        |
|            -(U)- - File #3 CRYO_REGEN - 157                       |
| _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                       |
| N7:29/1 - -(L)- - File #3 CRYO_REGEN - 157                        | N7:29
| _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                       +--(U)--
|                                                                       1
Rung #157
| MANUAL
| CONTROL
| CLOSE CRYO                                                         MANUAL CRYO
| ROUGH                                                              ROUGH 9
| VALVE 9                                                            OPEN
| M-CR9-O                                                            MCR9OP
|     N7:8                                                             N7:34
|----] [----------+-------------------------------------------------+---(U)---
|      1          |                                                 |    1
| |[2:3]          |                                                 |
| |               | N7:34/1 - -] [- - File #3 CRYO_REGEN - 171      |
| |               |             -(L)- - File #3 CRYO_REGEN - 156    |
| |COMPRESSOR     | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2     |
| |7 REGEN-   CRYO 9        | N7:29/1 - -(U)- - File #3 CRYO_REGEN - 156 |
| |ERATION    TEMPERATUR    | _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2 | N7:29
| |PROGRAM    =<20K   |                                             +--(L)--
| |CYRGN7     CY9TMP20|                                                 1
| |   B3         B3   |
| +---]/[------] [----+
|     327        509
| [243]
Rung #158
|MANUAL
|CONTROL
|CRYO ROUGE                                                          MANUAL CRYO
|VALVE 10                                                            ROUGH 10
|OPEN                                                                OPEN
|M-CR10-1                                                            MCR10OP
|  N7:13                                                               N7:34
|---] [-------------------------------------------------------------+---(L)---
|    2                                                              |    2
|[2:3]                                                              |
| N7:34/2 - -] [- - File #3 CRYO_REGEN - 172                        |
|            -(U)- - File #3 CRYO_REGEN - 159                       |
| _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                       |
| N7:29/2 - -(L)- - File #3 CRYO_REGEN - 159                        | N7:29
| _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                       +--(U)--
|                                                                       2
```

Rung #159

```
| MANUAL
| CONTROL
| CLOSE CRYO                                                        MANUAL CRYO
| ROUGH                                                             ROUGH 10
| VALVE 10                                                          OPEN
| M-CR10-O                                                          MCR10OP
|      N7:8                                                            N7:34
|------| |------------------------------------------------------------(U)-----|
| |      2                                                                2
| |[2:3]
| |                        N7:34/2 - -| |- - File #3 CRYO_REGEN - 172
| |                                 -(L)- - File #3 CRYO_REGEN - 158
| |COMPRESSOR              _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2
| |7 REGEN-     CRYO 10    N7:29/2 - -(U)- - File #3 CRYO_REGEN - 158
| |ERATION      TEMPERATUR _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2
| |PROGRAM      =<20K                                              N7:29
| |CYRGN7       CY10TMP20                                         --(L)--
| |   B3            B3                                                2
| |---|/|-----------| |---|
|     327           510
| [243]
```

Rung #160

```
|MANUAL
|CONTROL                                                            MANUAL CRYO
|CRYO 11                                                            ROUGH 11
|OPEN                                                               OPEN
 CR11-1                                                             MCR11OP
| N7:13                                                                N7:34
|---| |---------------------------------------------------------------(L)-----|
|    3                                                                    3
|[2:3]
| N7:34/3 - -| |- - File #3 CRYO_REGEN - 174
|            -(U)- - File #3 CRYO_REGEN - 161
| _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2
| N7:29/3 - -(L)- - File #3 CRYO_REGEN - 161                       N7:29
| _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2                     --(U)--
|                                                                     3
```

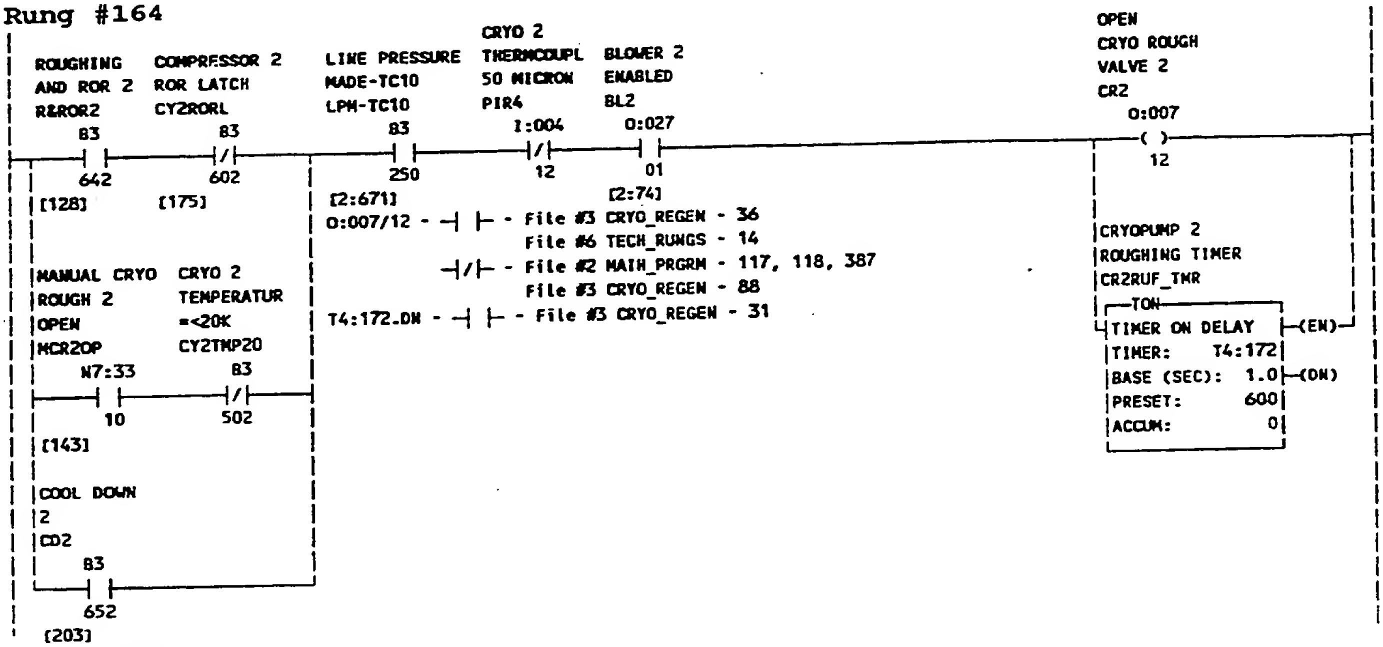
Rung #161

```
| MANUAL
| CONTROL                                                           MANUAL CRYO
| CLOSE CRYO                                                        ROUGH 11
| ROUGH                                                             OPEN
| VALVE 11                                                          MCR11OP
| M-CR11-O                                                             N7:34
|      N7:8
|------| |------------------------------------------------------------(U)-----|
| |      3                                                                3
  [2:3]
| |                        N7:34/3 - -| |- - File #3 CRYO_REGEN - 174
| |                                 -(L)- - File #3 CRYO_REGEN - 160
| |COMPRESSOR              _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2
| |8 REGEN-     CRYO 11    N7:29/3 - -(U)- - File #3 CRYO_REGEN - 160
| |ERATION      TEMPERATUR _F:N7:21[%21 - BTW - File #2 MAIN_PRGRM - 2
| |PROGRAM      =<20K                                              N7:29
| |CYRGN8       CY11TMP20                                         --(L)--
| |   B3            B3                                                3
| |---|/|-----------| |---|
|     328           511
| [244]
```

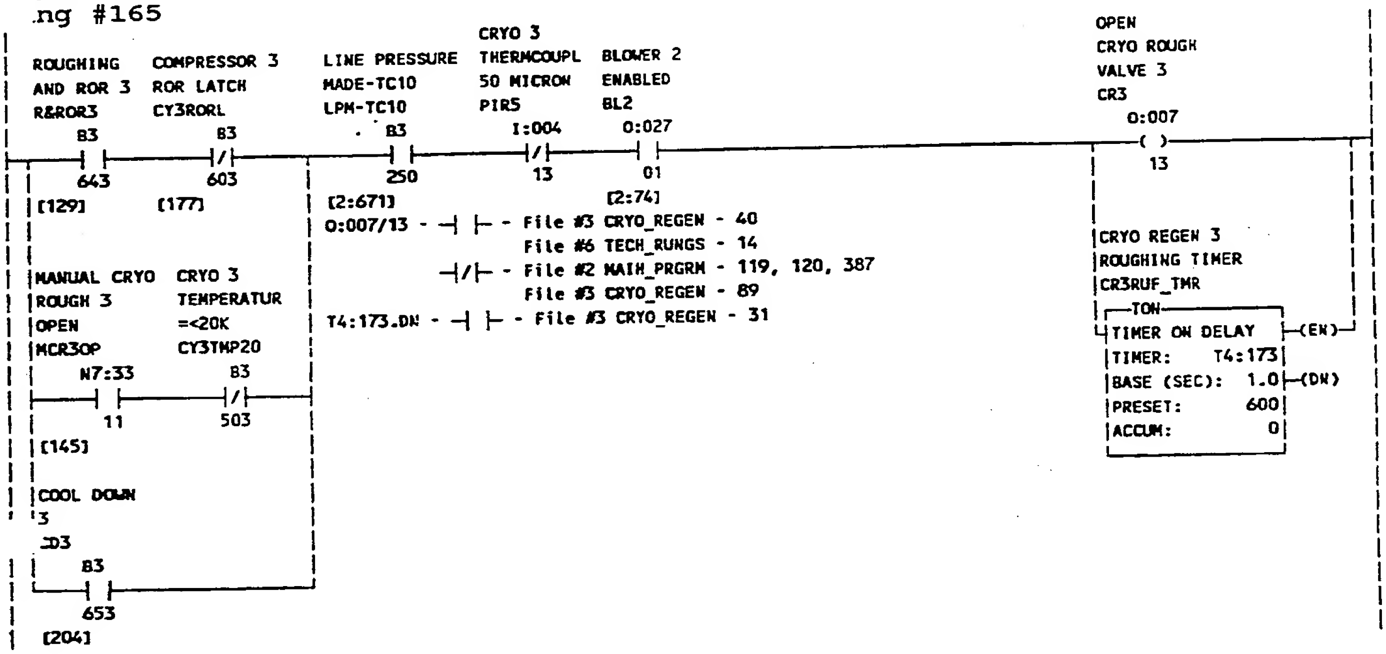
```
Rung #162
|MANUAL
|CONTROL
|CRYO ROUGH                                                          MANUAL CRYO
|VALVE 12                                                            ROUGH 12
|OPEN                                                                OPEN
|M-CR12-1                                                            MCR120P
|  N7:13                                                               N7:34
|---] [--------------------------------------------------------------+---(L)---+
|    4                                                               |    4    |
|[2:3]                                                               |         |
| N7:34/4 - -] [- - File #3 CRYO_REGEN - 173                         |         |
|          -(U)- - File #3 CRYO_REGEN - 163                          |         |
| _F:N7:21I%21 - BTW - File #2 MAIN_PRGRM - 2                        |         |
| N7:29/4 - -(L)- - File #3 CRYO_REGEN - 163                         | N7:29   |
| _F:N7:21I%21 - BTW - File #2 MAIN_PRGRM - 2                        +--(U)----+
|                                                                       4
Rung #163
| MANUAL
| CONTROL
| CLOSE CRYO                                                         MANUAL CRYO
| ROUGH                                                              ROUGH 12
| VALVE 12                                                           OPEN
| M-RV12-O                                                           MCR120P
|    N7:8                                                              N7:34
|-+---] [-------------------+----------------------------------------+---(U)---+
| |    4                    |                                        |    4    |
| |[2:3]                    | N7:34/4 - -] [- - File #3 CRYO_REGEN - 173       |
| |                         |          -(L)- - File #3 CRYO_REGEN - 162        |
| |COMPRESSOR               | _F:N7:21I%21 - BTW - File #2 MAIN_PRGRM - 2      |
| |7 REGEN-     CRYO 12     | N7:29/4 - -(U)- - File #3 CRYO_REGEN - 162       |
| |ERATION      TEMPERATUR  | _F:N7:21I%21 - BTW - File #2 MAIN_PRGRM - 2      |
| |PROGRAM      =<20K       |                                        | N7:29   |
| |CYRGN7       CY12TMP20   |                                        +--(L)----+
| |   B3           B3       |                                          4
| +---]/[----------] [------+
|    327          512
|  [243]
```

526

Rung #164



.ng #165



527

```
Rung #166
|                                              CRYO 5                                  OPEN                 |
| ROUGHING   COMPRESSOR 4   LINE PRESSURE  THERMCOUPL  BLOWER 2                       CRYO ROUGH           |
| AND ROR 4  ROR LATCH      MADE-TC10      50 MICRON   ENABLED                        VALVE 5              |
| R&ROR4     CY4RORL        LPM-TC10       PIR8        BL2                            CR5                  |
|    B3           B3            B3         I:024       O:027                            O:027              |
|---] [----------]/[----------] [----------]/[---------] [-------------------------------( )-------------|
| |  644          604     |     250         11          01                        |      12           | |
| |[130]       [179]      | [2:671]                  [2:74]                       |                   | |
| |                       | O:027/12 - ] [ - File #3 CRYO_REGEN - 44               |                   | |
| |                       |                  File #6 TECH_RUNGS - 14               |CRYO REGEN 5       | |
| |MANUAL CRYO  CRYO 5    |             ]/[ - File #2 MAIN_PRGRM - 123, 124, 387   |ROUGHING TIMER     | |
| |ROUGH 5      TEMPERATUR|                  File #3 CRYO_REGEN - 90               |CR5RUF_TMR         | |
| |OPEN         =<20K     | T4:175.DN - ] [ - File #3 CRYO_REGEN - 31              |+--TON-----------+ | |
| |MCR5OP       CY5TMP20  |                                                        +|TIMER ON DELAY  |-(EN)-+ |
| |   N7:33        B3     |                                                         |TIMER:    T4:175|       |
| |----] [--------]/[-----|                                                         |BASE (SEC):  1.0|-(DN)  |
| |    13          505    |                                                         |PRESET:      600|       |
| |[149]                  |                                                         |ACCUM:         0|       |
| |                       |                                                         +----------------+       |
| |COOL DOWN              |                                                                                  |
| |4                      |                                                                                  |
| |CD4                    |                                                                                  |
| |   B3                  |                                                                                  |
| |---] [-----------------|                                                                                  |
|    654                                                                                                     |
  [205]
Rung #167
|                                              CRYO 4                                  OPEN                 |
| ROUGHING   COMPRESSOR 5   LINE PRESSURE  THERMCOUPL  BLOWER 2                       CRYO ROUGH           |
| AND ROR 5  ROR LATCH      MADE-TC10      50 MICRON   ENABLED                        VALVE 4              |
| R&ROR5     CY5RORL        LPM-TC10       PIR7        BL2                            CR4                  |
|    B3           B3            B3         I:024       O:027                            O:027              |
|---] [----------]/[----------] [----------]/[---------] [-------------------------------( )-------------|
| |  645          605     |     250         10          01                        |      11           | |
| |[131]       [181]      | [2:671]                  [2:74]                       |                   | |
| |                       | O:027/11 - ] [ - File #3 CRYO_REGEN - 48               |                   | |
| |                       |                  File #6 TECH_RUNGS - 14               |CRYO REGEN 4       | |
| |MANUAL CRYO  CRYO 4    |             ]/[ - File #2 MAIN_PRGRM - 121, 122, 387   |ROUGHING TIMER     | |
| |ROUGH 4      TEMPERATUR|                  File #3 CRYO_REGEN - 91               |CR4RUF_TMR         | |
| |OPEN         =<20K     | T4:174.DN - ] [ - File #3 CRYO_REGEN - 31              |+--TON-----------+ | |
| |MCR4OP       CY4TMP20  |                                                        +|TIMER ON DELAY  |-(EN)-+ |
| |   N7:33        B3     |                                                         |TIMER:    T4:174|       |
| |----] [--------]/[-----|                                                         |BASE (SEC):  1.0|-(DN)  |
| |    12          504    |                                                         |PRESET:      600|       |
| |[147]                  |                                                         |ACCUM:         0|       |
| |                       |                                                         +----------------+       |
| |COOL DOWN              |                                                                                  |
| |5                      |                                                                                  |
| |CD5                    |                                                                                  |
| |   B3                  |                                                                                  |
| |---] [-----------------|                                                                                  |
|    655                                                                                                     |
|  [206]                                                                                                     |
```

```
Rung #168

 ROUGHING     COMPRESSOR 5   LINE PRESSURE  CRYO 6        BLOWER 2                        OPEN
 AND ROR 5    ROR LATCH      MADE-TC10      THERMCOUPL    ENABLED                         CRYO ROUGH
 R&ROR5       CY5RORL        LPM-TC10       50 MICRON     BL2                             VALVE 6
                                            PIR9                                          CR6
    B3           B3             B3          I:024         O:027                             O:027
---] [-------]/[--------------] [---------]/[----------] [-------------------------------( )---
    645          605            250          12            01                                13
 [131]        [181]          [2:671]                      [2:74]
                             O:027/13 - ] [ - File #3 CRYO_REGEN - 49
                                              File #6 TECH_RUNGS - 14                     CRYO REGEN 6
                                          ]/[ - File #2 MAIN_PRGRM - 125, 126, 387        ROUGHING TIMER
 MANUAL CRYO  CRYO 6                          File #3 CRYO_REGEN - 92                     CR6RUF_TMR
 ROUGH 6      TEMPERATUR     T4:176.DN - ] [ - File #3 CRYO_REGEN - 31                    +-TON----------------+
 OPEN         =<20K                                                                       |TIMER ON DELAY      |-(EN)-
 MCR6OP       CY6TMP20                                                                    |TIMER:       T4:176 |
   N7:33         B3                                                                       |BASE (SEC):     1.0 |-(DN)
---] [-------]/[---                                                                       |PRESET:         600 |
    14           506                                                                      |ACCUM:            0 |
 [151]                                                                                    +--------------------+

 COOL DOWN
 5
 CD5
    B3
---] [---
    655
 [206]

Rung #169

 ROUGHING     COMPRESSOR 5   LINE PRESSURE  CRYO 7        BLOWER 2                        OPEN
 AND ROR 5    ROR LATCH      MADE-TC10      THERMCOUPL    ENABLED                         CRYO ROUGH
 R&ROR5       CY5RORL        LPM-TC10       50 MICRON     BL2                             VALVE 7
                                            PIR12                                         CR7
    B3           B3             B3          I:040         O:027                             O:043
---] [-------]/[--------------] [---------]/[----------] [-------------------------------( )---
    645          605            250          10            01                                11
 [131]        [181]          [2:671]                      [2:74]
                             O:043/11 - ] [ - File #3 CRYO_REGEN - 50
                                              File #6 TECH_RUNGS - 14                     CRYO REGEN 7
                                          ]/[ - File #2 MAIN_PRGRM - 127, 128, 388        ROUGHING TIMER
 MANUAL CRYO  CRYO 7                          File #3 CRYO_REGEN - 93                     CR7RUF_TMR
 ROUGH 7      TEMPERATUR     T4:177.DN - ] [ - File #3 CRYO_REGEN - 31                    +-TON----------------+
 OPEN         =<20K                                                                       |TIMER ON DELAY      |-(EN)-
 MCR7OP       CY7TMP20                                                                    |TIMER:       T4:177 |
   N7:33         B3                                                                       |BASE (SEC):     1.0 |-(DN)
---] [-------]/[---                                                                       |PRESET:         600 |
    15           507                                                                      |ACCUM:            0 |
 [153]                                                                                    +--------------------+

 COOL DOWN
 5
 CD5
    B3
---] [---
    655
 [206]
```

Rung #170

```
                                                           CRYO 8                                           OPEN
 ROUGHING      COMPRESSOR 6   LINE PRESSURE   THERMCOUPL   BLOWER 2                                         CRYO ROUGH
 AND ROR 6     ROR LATCH      MADE-TC10       50 MICRON    ENABLED                                          VALVE 8
 R&ROR6        CY6RORL        LPM-TC10        PIR13        BL2                                              CR8
    B3            B3              B3          I:040        O:027                                              O:043
---] [-----------]/[------------] [-----------]/[----------] [-------------------------------------------------( )---
   646           606             250           11           01                                                12
 [132]         [183]          [2:671]                    [2:74]
                              O:043/12 - ] [ - File #3 CRYO_REGEN - 55
                                               File #6 TECH_RUNGS - 14                               CRYO REGEN 8
                                         ]/[ - File #2 MAIN_PRGRM - 129, 130, 388                    ROUGHING TIMER
 MANUAL CRYO   CRYO 8                          File #3 CRYO_REGEN - 94                               CR8RUF_TMR
 ROUGH 8       TEMPERATUR     T4:178.DN - ] [ - File #3 CRYO_REGEN - 31                              +-TON---------------+
 OPEN          =<20K                                                                                 |TIMER ON DELAY     |-(EN)-
 MCR8OP        CY8TMP20                                                                              |TIMER:      T4:178 |
   N7:34          B3                                                                                 |BASE (SEC):    1.0 |-(DN)
---] [-----------]/[---                                                                              |PRESET:        600 |
    0            508                                                                                 |ACCUM:           0 |
 [155]                                                                                               +-------------------+

 COOL DOWN
 6
 CD6
    B3
---] [---
   656
 [207]
```

Rung #171

```
                                                           CRYO 9                                           OPEN
 ROUGHING      COMPRESSOR 7   LINE PRESSURE   THERMCOUPL   BLOWER 2                                         CRYO ROUGH
 AND ROR 7     ROR LATCH      MADE-TC10       50 MICRON    ENABLED                                          VALVE 9
 R&ROR7        CY7RORL        LPM-TC10        PIR14        BL2                                              CR9
    B3            B3              B3          I:040        O:027                                              O:043
---] [-----------]/[------------] [-----------]/[----------] [-------------------------------------------------( )---
   647           607             250           12           01                                                13
 [133]         [185]          [2:671]                    [2:74]
                              O:043/13 - ] [ - File #3 CRYO_REGEN - 59
                                               File #6 TECH_RUNGS - 14                               CRYO REGEN 9
                                         ]/[ - File #2 MAIN_PRGRM - 131, 132, 388                    ROUGHING TIMER
 MANUAL CRYO   CRYO 9                          File #3 CRYO_REGEN - 95                               CR9RUF_TMR
 ROUGH 9       TEMPERATUR     T4:179.DN - ] [ - File #3 CRYO_REGEN - 31                              +-TON---------------+
 OPEN          =<20K                                                                                 |TIMER ON DELAY     |-(EN)-
 MCR9OP        CY9TMP20                                                                              |TIMER:      T4:179 |
   N7:34          B3                                                                                 |BASE (SEC):    1.0 |-(DN)
---] [-----------]/[---                                                                              |PRESET:        600 |
    1            509                                                                                 |ACCUM:           0 |
 [157]                                                                                               +-------------------+

 COOL DOWN
 7
 D7
    B3
---] [---
   657
 [208]
```

530

```
Rung #172
                                                 CRYO 10                                     OPEN
 ROUGHING     COMPRESSOR 7     LINE PRESSURE   THERMCOUPL   BLOWER 2                         CRYO ROUGH
 AND ROR 7    ROR LATCH        MADE-TC10       50 MICRON    ENABLED                          VALVE 10
 R&ROR7       CY7RORL          LPM-TC10        PIR18        BL2.                             CR10
    B3            B3               B3            I:054       O:027                             O:057
---] [-----------]/[-----------] [-----------]/[---------] [-----------------------------------( )---
    647           607              250            11          01                                11
 [133]        [185]            [2:671]                      [2:74]
                               O:057/11 - -] [- - File #3 CRYO_REGEN - 60
                                                  File #6 TECH_RUNGS - 14
                                            -]/[- - File #2 MAIN_PRGRM - 133, 134, 388
                                                  File #3 CRYO_REGEN - 96
                               T4:180.DN - -] [- - File #3 CRYO_REGEN - 31
                                                                                        CRYO REGEN 10
 MANUAL CRYO   CRYO 10                                                                  ROUGHING TIMER
 ROUGH 10      TEMPERATUR                                                               CR10RUF_TMR
 OPEN          =<20K                                                                    TON
 MCR10OP       CY10TMP20                                                                TIMER ON DELAY   (EN)
    N7:34          B3                                                                   TIMER:     T4:180
---] [-----------]/[---                                                                 BASE (SEC):   1.0 (DN)
    2              510                                                                  PRESET:       600
 [159]                                                                                  ACCUM:          0

 COOL DOWN
 7
 CD7
    B3
---] [---
    657
 [208]
Rung #173
                                                 CRYO 12                                     OPEN
 ROUGHING     COMPRESSOR 7     LINE PRESSURE   THERMCOUPL   BLOWER 2                         CRYO ROUGH
 AND ROR 7    ROR LATCH        MADE-TC10       50 MICRON    ENABLED                          VALVE 12
 R&ROR7       CY7RORL          LPM-TC10        PIR20        BL2                              CR12
    B3            B3               B3            I:054       O:027                             O:057
---] [-----------]/[-----------] [-----------]/[---------] [-----------------------------------( )---
    647           607              250            13          01                                13
 [133]        [185]            [2:671]                      [2:74]
                               O:057/13 - -] [- - File #3 CRYO_REGEN - 61
                                                  File #6 TECH_RUNGS - 14
                                            -]/[- - File #2 MAIN_PRGRM - 137, 138, 388
                                                  File #3 CRYO_REGEN - 97
                               T4:182.DN - -] [- - File #3 CRYO_REGEN - 31
                                                                                        CRYO REGEN 12
 MANUAL CRYO   CRYO 12                                                                  ROUGHING TIMER
 ROUGH 12      TEMPERATUR                                                               CR12RUF_TMR
 OPEN          =<20K                                                                    TON
 MCR12OP       CY12TMP20                                                                TIMER ON DELAY   (EN)
    N7:34          B3                                                                   TIMER:     T4:182
---] [-----------]/[---                                                                 BASE (SEC):   1.0 (DN)
    4              512                                                                  PRESET:       600
 [163]                                                                                  ACCUM:          0

 COOL DOWN
 7
 D7
    B3
---] [---
    657
 [208]
```

531

Rung #174

```
ROUGHING     COMPRESSOR 8  LINE PRESSURE  CRYO 11      BLOWER 2                        OPEN
AND ROR 8    ROR LATCH     MADE-TC10      THERMCOUPL   ENABLED                         CRYO ROUGH
R&ROR8       CY8RORL       LPN-TC10       50 MICRON    BL2                             VALVE 11
B3           B3            B3             PIR19        0:027                           CR11
648          608           250            I:054        01                              0:057
[134]        [187]         [2:671]        12           [2:74]                          -( )-
                                                                                       12
                           0:057/12 - -| |- - File #3 CRYO_REGEN - 65
                                              File #6 TECH_RUNGS - 14                  CRYO REGEN 11
                                       -|/|- - File #2 MAIN_PRGRM - 135, 136, 388      ROUGHING TIMER
                                              File #3 CRYO_REGEN - 98                  CR11RUF_TMR
MANUAL CRYO  CRYO 11       T4:181.DN - -| |- - File #3 CRYO_REGEN - 31                 TON
ROUGH 11     TEMPERATUR                                                                TIMER ON DELAY  -(EN)-
OPEN         =<20K                                                                     TIMER:     T4:181
MCR110P      CY11TMP20                                                                 BASE (SEC):   1.0 -(DN)
N7:34        B3                                                                        PRESET:       600
3            511                                                                       ACCUM:          0
[161]

COOL DOWN
8
CD8
B3
658
[209]
```

ng #175

```
ROUGHING     CRYO 2       BLOWER 2    CRYO 2                                COMPRESSOR 2
AND ROR 2    THERMCOUPL   ENABLED     ROR LATCH                             ROR LATCH
R&ROR2       50 MICRON    BL2         ONE SHOT                              CY2RORL
B3           PIR4         0:027       C2RORLOS                              B3
642          I:004        01          B3                                    -(L)-
[210]        12           [2:74]      [ONS]                                 602
                                      552
B3/602 - -| |- - File #3 CRYO_REGEN - 189
                 File #6 TECH_RUNGS - 17
         -|/|- - File #3 CRYO_REGEN - 164
         -(L)- - File #3 CRYO_REGEN - 175
         -(U)- - File #3 CRYO_REGEN - 176
```

Rung #176

```
ROUGHING     ROR WAIT                                                       COMPRESSOR 2
AND ROR 2    COMPRESSOR                                                     ROR LATCH
R&ROR2       2  60 SEC                                                      CY2RORL
B3           DONE                                                           B3
642          C2RORTMR                                                       -(U)-
[210]        T4:32                                                          602
             DN
             [189]     B3/602 - -| |- - File #3 CRYO_REGEN - 189
                                        File #6 TECH_RUNGS - 17
COMPRESSOR                      -|/|- - File #3 CRYO_REGEN - 164
2 REGEN-                        -(L)- - File #3 CRYO_REGEN - 175
ERATION
PROGRAM
CYRGN2
B3
322
[238]
```

```
Rung #177
|           CRYO 3                  CRYO 3
|ROUGHING   THERMCOUPL  BLOWER 2   ROR LATCH                                              COMPRESSOR 3 |
|AND ROR 3  50 MICRON   ENABLED    ONE SHOT                                               ROR LATCH    |
|R&ROR3     PIR5        BL2        C3RORLOS                                               CY3RORL      |
|   B3        I:004      O:027       B3                                                        B3      |
|---] [--------] [--------] [--------[ONS]---------------------------------------------------(L)-------|
|   643         13         01       553                                                        603     |
|[211]                  [2:74]
B3/603 - ] [ - File #3 CRYO_REGEN - 190
               File #6 TECH_RUNGS - 17
         ]/[ - File #3 CRYO_REGEN - 165
         (L) - File #3 CRYO_REGEN - 177
         (U) - File #3 CRYO_REGEN - 178
Rung #178
|              ROR WAIT
|              COMPRESSOR
|  ROUGHING    3   60 SEC                                                                 COMPRESSOR 3 |
|  AND ROR 3   DONE                                                                       ROR LATCH    |
|  R&ROR3      C3RORTMR                                                                   CY3RORL      |
|     B3         T4:33                                                                         B3      |
|-+---] [---------] [-----+------------------------------------------------------------------(U)-------|
| |    643         DN     |                                                                    603     |
| |[211]        [190]     |
| |                       | B3/603 - ] [ - File #3 CRYO_REGEN - 190
| |                       |                File #6 TECH_RUNGS - 17
| |COMPRESSOR             |          ]/[ - File #3 CRYO_REGEN - 165
| |3 REGEN-               |          (L) - File #3 CRYO_REGEN - 177
| |ERATION                |
| |PROGRAM                |
| |CYRGN3                 |
| |    B3                 |
| +---]/[-----------------+
|     323
|  [239]
Rung #179
|           CRYO 5                  CRYO 4
|ROUGHING   THERMCOUPL  BLOWER 2   ROR LATCH                                              COMPRESSOR 4 |
|AND ROR 4  50 MICRON   ENABLED    ONE SHOT                                               ROR LATCH    |
|R&ROR4     PIR8        BL2        C4RORLOS                                               CY4RORL      |
|   B3        I:024      O:027       B3                                                        B3      |
|---] [--------] [--------] [--------[ONS]---------------------------------------------------(L)-------|
|   644         11         01       554                                                        604     |
|[212]                  [2:74]
B3/604 - ] [ - File #3 CRYO_REGEN - 191
               File #6 TECH_RUNGS - 17
         ]/[ - File #3 CRYO_REGEN - 166
         (L) - File #3 CRYO_REGEN - 179
         (U) - File #3 CRYO_REGEN - 180
```

533

```
Rung #180
|              ROR WAIT
|              COMPRESSOR
| ROUGHING     4    60 SEC                                                        COMPRESSOR 4
| AND ROR 4    DONE                                                               ROR LATCH
| R&ROR4       C4RORTMR                                                           CY4RORL
|     B3          T4:34                                                              B3
|-+---| |--------| |---+---------------------------------------------------------------(U)----|
| |   644          DN  |                                                                604
| |[212]       [191]   |
| |                    | B3/604 - -| |- - File #3 CRYO_REGEN - 191
| |                    |                  File #6 TECH_RUNGS - 17
| |COMPRESSOR          |          -|/|- - File #3 CRYO_REGEN - 166
| |4 REGEN-            |          -(L)- - File #3 CRYO_REGEN - 179
| |ERATION             |
| |PROGRAM             |
| |CYRGN4              |
| |     B3             |
| +----|/|-------------+
|      324
| [240]
Rung #181
|          CRYO 4      CRYO 6      CRYO 7                   CRYO 5
|ROUGHING  THERMCOUPL  THERMCOUPL  THERMCOUPL  BLOWER 2     ROR LATCH                 COMPRESSOR 5
|AND ROR 5 50 MICRON   50 MICRON   50 MICRON   ENABLED      ONE SHOT                  ROR LATCH
|R&ROR5    PIR7        PIR9        PIR12       BL2          C5RORLOS                  CY5RORL
|   B3        I:024       I:024       I:040       0:027        B3                       B3
|---| |--------| |---------| |---------| |---------| |--------[ONS]---------------------(L)-----|
|   645         10          12          10          01         555                      605
|[213]                                          [2:74]
B3/605 - -| |- - File #3 CRYO_REGEN -  192
                 File #6 TECH_RUNGS -  17
         -|/|- - File #3 CRYO_REGEN -  167,168,169
         -(L)- - File #3 CRYO_REGEN -  181
         -(U)- - File #3 CRYO_REGEN -  182
Rung #182
|              ROR WAIT
|              COMPRESSOR
| ROUGHING     5    60 SEC                                                        COMPRESSOR 5
| AND ROR 5    DONE                                                               ROR LATCH
| R&ROR5       C5RORTMR                                                           CY5RORL
|     B3          T4:35                                                              B3
|-+---| |--------| |---+---------------------------------------------------------------(U)----|
| |   645          DN  |                                                                605
| |[213]       [192]   |
| |                    | B3/605 - -| |- - File #3 CRYO_REGEN - 192
| |                    |                  File #6 TECH_RUNGS - 17
| |COMPRESSOR          |          -|/|- - File #3 CRYO_REGEN - 167, 168, 169
| |5 REGEN-            |          -(L)- - File #3 CRYO_REGEN - 181
|  ERATION             |
| |PROGRAM             |
| |CYRGN5              |
| |     B3             |
| +----|/|-------------+
|      325
| [241]
```

534

```
Rung #183
|        CRYO 8                 CRYO 6
|ROUGHING THERMCOUPL BLOWER 2  ROR LATCH                         COMPRESSOR 6 |
|AND ROR 6 50 MICRON ENABLED   ONE SHOT                          ROR LATCH    |
|R&ROR6   PIR13      BL2       C6RORLOS                          CY6RORL      |
|  B3      I:040     O:027       B3                                 B3        |
|--] [------] [-------] [--------[ONS]-------------------------------(L)------|
|  646      11        01         556                                606       |
|[214]             [2:74]
B3/606 - -] [- - File #3 CRYO_REGEN - 193
                 File #6 TECH_RUNGS - 17
         -]/[- - File #3 CRYO_REGEN - 170
         -(L)- - File #3 CRYO_REGEN - 183
         -(U)- - File #3 CRYO_REGEN - 184
Rung #184
|               ROR WAIT
|               COMPRESSOR                                       COMPRESSOR 6 |
| ROUGHING      6   60 SEC                                       ROR LATCH    |
| AND ROR 6     DONE                                             CY6RORL      |
| R&ROR6        C6RORTMR                                            B3        |
|   B3          T4:36                                                         |
|---] [----------] [------+-------------------------------------------(U)-----|
| |  646         DN       |                                         606       |
| |[214]        [193]     |
| |                       | B3/606 - -] [- - File #3 CRYO_REGEN - 193
| |                       |                  File #6 TECH_RUNGS - 17
| |COMPRESSOR             |          -]/[- - File #3 CRYO_REGEN - 170
|  6 REGEN-               |          -(L)- - File #3 CRYO_REGEN - 183
| |ERATION                |
| |PROGRAM                |
| |CYRGN6                 |
| |   B3                  |
| +---]/[-----------------+
|     326
| [242]
Rung #185
|         CRYO 10    CRYO 9     CRYO 12               CRYO 7
|ROUGHING THERMCOUPL THERMCOUPL THERMCOUPL BLOWER 2   ROR LATCH              COMPRESSOR 7 |
|AND ROR 7 50 MICRON 50 MICRON 50 MICRON   ENABLED    ONE SHOT               ROR LATCH    |
|R&ROR7   PIR18      PIR14      PIR20      BL2        C7RORLOS               CY7RORL      |
|  B3      I:054      I:040      I:054     O:027        B3                      B3        |
|--] [------] [--------] [--------] [--------] [---------[ONS]--------------------(L)-----|
|  647       11         12         13        01         557                     607       |
|[215]                                     [2:74]
B3/607 - -] [- - File #3 CRYO_REGEN - 194
                 File #6 TECH_RUNGS - 17
         -]/[- - File #3 CRYO_REGEN - 171,172,173
         -(L)- - File #3 CRYO_REGEN - 185
         -(U)- - File #3 CRYO_REGEN - 186
```

```
Rung #186
|              ROR WAIT
|              COMPRESSOR
| ROUGHING     7   60 SEC                                                     COMPRESSOR 7 |
| AND ROR 7    DONE                                                           ROR LATCH    |
| R&ROR7       C7RORTMR                                                       CY7RORL      |
|     B3         T4:37                                                           B3        |
|----] [---------] [----+--------------------------------------------------------(U)-------|
| |   647          DN   |                                                        607       |
| |[215]       [194]    |                                                                  |
| |                     | B3/607 - ] [ - File #3 CRYO_REGEN - 194                          |
| |                     |                File #6 TECH_RUNGS - 17                           |
| |COMPRESSOR           |          ]/[ - File #3 CRYO_REGEN - 171, 172, 173                |
| |7 REGEN-             |          (L) - File #3 CRYO_REGEN - 185                          |
| |ERATION              |                                                                  |
| |PROGRAM              |                                                                  |
| |CYRGN7               |                                                                  |
| |   B3                |                                                                  |
| +---]/[---------------+                                                                  |
|     327                                                                                  |
| [243]                                                                                    |
Rung #187
|             CRYO 11                CRYO 8
|ROUGHING     THERMCOUPL  BLOWER 2   ROR LATCH                                COMPRESSOR 8 |
|AND ROR 8    50 MICRON   ENABLED    ONE SHOT                                 ROR LATCH    |
|R&ROR8       PIR19       BL2        C8RORLOS                                 CY8RORL      |
    B3          I:054      O:027       B3                                        B3        |
|---] [---------] [---------] [-------[ONS]--------------------------------------(L)-------|
|   648          12          01        558                                       608       |
|[216]                     [2:74]                                                          |
B3/608 - ] [ - File #3 CRYO_REGEN - 195
               File #6 TECH_RUNGS - 17
         ]/[ - File #3 CRYO_REGEN - 174
         (L) - File #3 CRYO_REGEN - 187
         (U) - File #3 CRYO_REGEN - 188
Rung #188
|              ROR WAIT                                                                    |
|              COMPRESSOR                                                                  |
| ROUGHING     8   60 SEC                                                     COMPRESSOR 8 |
| AND ROR 8    DONE                                                           ROR LATCH    |
| R&ROR8       C8RORTMR                                                       CY8RORL      |
|     B3         T4:38                                                           B3        |
|----] [---------] [----+--------------------------------------------------------(U)-------|
| |   648          DN   |                                                        608       |
| |[216]       [195]    |                                                                  |
| |                     | B3/608 - ] [ - File #3 CRYO_REGEN - 195                          |
| |                     |                File #6 TECH_RUNGS - 17                           |
| |COMPRESSOR           |          ]/[ - File #3 CRYO_REGEN - 174                          |
| |8 REGEN-             |          (L) - File #3 CRYO_REGEN - 187                          |
| |ERATION              |                                                                  |
| |PROGRAM              |                                                                  |
| |CYRGN8               |                                                                  |
| |   B3                |                                                                  |
| +---]/[---------------+                                                                  |
|     328                                                                                  |
| [244]                                                                                    |
```

```
Rung #189
|                                                         ROR WAIT              |
|ROUGHING   COMPRESSOR 2                                  COMPRESSOR            |
|AND ROR 2  ROR LATCH                                     2   60 SEC            |
|R&ROR2     CY2RORL                                       C2RORTMR              |
|   B3             B3                                     +-TON-----------+     |
|---] [-----------] [-------------------------------------|TIMER ON DELAY |-(EN)-|
|   642           602                                     |TIMER:    T4:32|     |
|[210]        [176]                                       |BASE (SEC): 1.0|-(DN) |
|                                                         |PRESET:      30|     |
|                                                         |ACCUM:        0|     |
|                                                         +---------------+     |
T4:32.DN - ] [ - File #3 CRYO_REGEN -  176,196,203
T4:32.TT - ] [ - File #6 TECH_RUNGS -  18
Rung #190
|                                                         ROR WAIT              |
|ROUGHING   COMPRESSOR 3                                  COMPRESSOR            |
|AND ROR 3  ROR LATCH                                     3   60 SEC            |
|R&ROR3     CY3RORL                                       C3RORTMR              |
|   B3             B3                                     +-TON-----------+     |
|---] [-----------] [-------------------------------------|TIMER ON DELAY |-(EN)-|
|   643           603                                     |TIMER:    T4:33|     |
|[211]        [178]                                       |BASE (SEC): 1.0|-(DN) |
|                                                         |PRESET:      30|     |
|                                                         |ACCUM:        0|     |
|                                                         +---------------+     |
T4:33.DN - ] [ - File #3 CRYO_REGEN -  178,197,204
T4:33.TT - ] [ - File #6 TECH_RUNGS -  18
Rung #191
|                                                         ROR WAIT              |
|ROUGHING   COMPRESSOR 4                                  COMPRESSOR            |
|AND ROR 4  ROR LATCH                                     4   60 SEC            |
|R&ROR4     CY4RORL                                       C4RORTMR              |
|   B3             B3                                     +-TON-----------+     |
|---] [-----------] [-------------------------------------|TIMER ON DELAY |-(EN)-|
|   644           604                                     |TIMER:    T4:34|     |
|[212]        [180]                                       |BASE (SEC): 1.0|-(DN) |
|                                                         |PRESET:      30|     |
|                                                         |ACCUM:        0|     |
|                                                         +---------------+     |
T4:34.DN - ] [ - File #3 CRYO_REGEN -  180,198,205
T4:34.TT - ] [ - File #6 TECH_RUNGS -  18
Rung #192
|                                                         ROR WAIT              |
|ROUGHING   COMPRESSOR 5                                  COMPRESSOR            |
|AND ROR 5  ROR LATCH                                     5   60 SEC            |
|R&ROR5     CY5RORL                                       C5RORTMR              |
|   B3             B3                                     +-TON-----------+     |
|---] [-----------] [-------------------------------------|TIMER ON DELAY |-(EN)-|
|   645           605                                     |TIMER:    T4:35|     |
|[213]        [182]                                       |BASE (SEC): 1.0|-(DN) |
|                                                         |PRESET:      30|     |
|                                                         |ACCUM:        0|     |
|                                                         +---------------+     |
T4:35.DN - ] [ - File #3 CRYO_REGEN -  182,199,206
T4:35.TT - ] [ - File #6 TECH_RUNGS -  18
```

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```
Rung #193
|                                                                    ROR WAIT                |
|ROUGHING   COMPRESSOR 6                                             COMPRESSOR              |
|AND ROR 6  ROR LATCH                                                6   60 SEC              |
|R&ROR6     CY6RORL                                                  C6RORTMR                |
|   B3          B3                                                   +--TON--------------+   |
|---] [--------] [---------------------------------------------------+TIMER ON DELAY     +-(EN)-|
|   646         606                                                  |TIMER:       T4:36|    |
|[214]      [184]                                                    |BASE (SEC):    1.0+-(DN) |
|                                                                    |PRESET:         30|    |
|                                                                    |ACCUM:           0|    |
|                                                                    +-------------------+   |
T4:36.DN - ] [ - File #3 CRYO_REGEN -  184,200,207
T4:36.TT - ] [ - File #6 TECH_RUNGS -  18
Rung #194
|                                                                    ROR WAIT                |
|ROUGHING   COMPRESSOR 7                                             COMPRESSOR              |
|AND ROR 7  ROR LATCH                                                7   60 SEC              |
|R&ROR7     CY7RORL                                                  C7RORTMR                |
|   B3          B3                                                   +--TON--------------+   |
|---] [--------] [---------------------------------------------------+TIMER ON DELAY     +-(EN)-|
|   647         607                                                  |TIMER:       T4:37|    |
|[215]      [186]                                                    |BASE (SEC):    1.0+-(DN) |
|                                                                    |PRESET:         30|    |
|                                                                    |ACCUM:           0|    |
|                                                                    +-------------------+   |
T4:37.DN - ] [ - File #3 CRYO_REGEN -  186,201,208
T4:37.TT - ] [ - File #6 TECH_RUNGS -  18
Rung #195
|                                                                    ROR WAIT                |
|ROUGHING   COMPRESSOR 8                                             COMPRESSOR              |
|AND ROR 8  ROR LATCH                                                8   60 SEC              |
|R&ROR8     CY8RORL                                                  C8RORTMR                |
|   B3          B3                                                   +--TON--------------+   |
|---] [--------] [---------------------------------------------------+TIMER ON DELAY     +-(EN)-|
|   648         608                                                  |TIMER:       T4:38|    |
|[216]      [188]                                                    |BASE (SEC):    1.0+-(DN) |
|                                                                    |PRESET:         30|    |
|                                                                    |ACCUM:           0|    |
|                                                                    +-------------------+   |
T4:38.DN - ] [ - File #3 CRYO_REGEN -  188,202,209
T4:38.TT - ] [ - File #6 TECH_RUNGS -  18
Rung #196
|           ROR WAIT                                                  REROUGH                |
|           COMPRESSOR  CRYO 2                                        COUNTER                |
|ROUGHING   2   60 SEC  THERMCOUPL                                    COMPRESSOR             |
|AND ROR 2  DONE        50 MICRON                                     2                      |
|R&ROR2     C2RORTMR    PIR4                                          C2RERUF                |
|   B3        T4:32       I:004                                       +--CTU-------------+   |
|---] [--------] [---------]/[----------------------------------------+COUNT UP          +-(CU)-|
|   642         DN         12                                         |COUNTER:      C5:2|    |
|[210]      [189]                                                     |PRESET:         10+-(DN) |
|                                                                     |ACCUM:           0|    |
|                                                                     +------------------+   |
C5:2 - CTU - File #3 CRYO_REGEN -  196
       RES - File #3 CRYO_REGEN -  224
C5:2.DN - ] [ - File #2 MAIN_PRGRM -  623,623
```

```
Rung #197
|             ROR WAIT                                                          REROUGH            |
|             COMPRESSOR  CRYO 3                                                COUNTER            |
|ROUGHING     3   60 SEC  THERMCOUPL                                            COMPRESSOR         |
|AND ROR 3    DONE        50 MICRON                                             3                  |
|R&ROR3       C3RORTMR    PIR5                                                  C3RERUF            |
|  B3           T4:33       I:004                                               ┌─CTU──────────┐   |
|──┤ ├──────────┤ ├─────────┤/├─────────────────────────────────────────────────┤COUNT UP      ├─(CU)─┤
|  643           DN          13                                                 |COUNTER:  C5:3|   |
|[211]        [190]                                                             |PRESET:     15├─(DN) |
|                                                                               |ACCUM:       0|   |
|                                                                               └──────────────┘   |
C5:3 - CTU - File #3 CRYO_REGEN -  197
       RES - File #3 CRYO_REGEN -  225
C5:3.DN - ┤ ├ - File #2 MAIN_PRGRM -  623
Rung #198
|             ROR WAIT                                                          REROUGH            |
|             COMPRESSOR  CRYO 5                                                COUNTER            |
|ROUGHING     4   60 SEC  THERMCOUPL                                            COMPRESSOR         |
|AND ROR 4    DONE        50 MICRON                                             4                  |
|R&ROR4       C4RORTMR    PIR8                                                  C4RERUF            |
|  B3           T4:34       I:024                                               ┌─CTU──────────┐   |
|──┤ ├──────────┤ ├─────────┤/├─────────────────────────────────────────────────┤COUNT UP      ├─(CU)─┤
|  644           DN          11                                                 |COUNTER:  C5:4|   |
|[212]        [191]                                                             |PRESET:     10├─(DN) |
|                                                                               |ACCUM:       0|   |
|                                                                               └──────────────┘   |
 .4 - CTU - File #3 CRYO_REGEN -  198
       RES - File #3 CRYO_REGEN -  226
C5:4.DN - ┤ ├ - File #2 MAIN_PRGRM -  623
Rung #199
|             ROR WAIT                                                          REROUGH            |
|             COMPRESSOR     CRYO 4                                             COUNTER            |
|ROUGHING     5   60 SEC     THERMCOUPL                                         COMPRESSOR         |
|AND ROR 5    DONE           50 MICRON                                          5                  |
|R&ROR5       C5RORTMR       PIR7                                               C5RERUF            |
|  B3           T4:35           I:024                                           ┌─CTU──────────┐   |
|──┤ ├──────────┤ ├──────┬──────┤/├──────┬──────────────────────────────────────┤COUNT UP      ├─(CU)─┤
|  645           DN      |       10      |                                      |COUNTER:  C5:5|   |
|[213]        [192]      |               |                                      |PRESET:     10├─(DN) |
|                        |               | C5:5 - RES - File #3 CRYO_REGEN - 227|ACCUM:       0|   |
|                        |CRYO 6         | C5:5.DN - ┤ ├ - File #2 MAIN_PRGRM - 623──────────┘   |
|                        |THERMCOUPL     |                                                         |
|                        |50 MICRON      |                                                         |
|                        |PIR9           |                                                         |
|                        |   I:024       |                                                         |
|                        ├──────┤/├──────┤                                                         |
|                        |       12      |                                                         |
|                        |CRYO 7         |                                                         |
|                        |THERMCOUPL     |                                                         |
|                        |50 MICRON      |                                                         |
|                        |PIR12          |                                                         |
|                        |   I:040       |                                                         |
|                        └──────┤/├──────┘                                                         |
|                               10                                                                 |
```

Rung #200

```
|            ROR WAIT                                              REROUGH
|            COMPRESSOR  CRYO 8                                    COUNTER
|ROUGHING    6   60 SEC  THERMCOUPL                                COMPRESSOR
|AND ROR 6   DONE        50 MICRON                                 6
|R&ROR6      C6RORTMR    PIR13                                     C6R3RUF
|  B3          T4:36       I:040                                   CTU
|--] [--------] [----------]/[-------------------------------------|COUNT UP        |-(CU)-
|  646          DN          11                                     |COUNTER:   C5:6|
|[214]       [193]                                                 |PRESET:      10|-(DN)
|                                                                  |ACCUM:        0|
```

C5:6 - CTU - File #3 CRYO_REGEN - 200
RES - File #3 CRYO_REGEN - 228
C5:6.DN -] [- File #2 MAIN_PRGRM - 623

Rung #201

```
|            ROR WAIT                                              REROUGH
|            COMPRESSOR    CRYO 9                                  COUNTER
|ROUGHING    7   60 SEC    THERMCOUPL                              COMPRESSOR
|AND ROR 7   DONE          50 MICRON                               7
|R&ROR7      C7RORTMR      PIR14                                   C7RERUF
|  B3          T4:37         I:040                                 CTU
|--] [--------] [--------+----]/[----+-----------------------------|COUNT UP        |-(CU)-
|  647          DN       |     12    |                             |COUNTER:   C5:7|
|[215]       [194]       |           |                             |PRESET:      10|-(DN)
|                        |           | C5:7 - RES - File #3 CRYO_REGEN - 229  |ACCUM: 0|
|                        |CRYO 10    | C5:7.DN - ] [ - File #2 MAIN_PRGRM - 623
|                        |THERMCOUPL |
|                        |50 MICRON  |
|                        |PIR18      |
|                        |   I:054   |
|                        |----]/[----|
|                        |     11    |
|                        |CRYO 12    |
|                        |THERMCOUPL |
|                        |50 MICRON  |
|                        |PIR20      |
|                        |   I:054   |
|                        +----]/[----+
|                            13
```

Rung #202

```
|            ROR WAIT                                              REROUGH
|            COMPRESSOR  CRYO 11                                   COUNTER
|ROUGHING    8   60 SEC  THERMCOUPL                                COMPRESSOR
|AND ROR 8   DONE        50 MICRON                                 8
|R&ROR8      C8RORTMR    PIR19                                     C8RERUF
|  B3          T4:38       I:054                                   CTU
|--] [--------] [----------]/[-------------------------------------|COUNT UP        |-(CU)-
  648          DN          12                                      |COUNTER:   C5:8|
 [216]       [195]                                                 |PRESET:      10|-(DN)
|                                                                  |ACCUM:        0|
```

C5:8 - CTU - File #3 CRYO_REGEN - 202
RES - File #3 CRYO_REGEN - 230
C5:8.DN -] [- File #2 MAIN_PRGRM - 623

540

```
Rung #203
|
|                           ROR WAIT
|              CRYO 2       COMPRESSOR  CRYO 2                                                   COOL DOWN |
|ROUGHING      THERMCOUPL   2   60 SEC  TEMPERATUR                                               2         |
|AND ROR 2     50 MICRON    DONE        =<20K                                                    CD2       |
|R&ROR2        PIR4         C2RORTMR    CY2TMP20                                                   B3      |
|   B3            I:004        T4:32       B3                                                             |
|---] [-----------] [-----------] [---------]/[----------------------------------------------------(L)-----|
|   642           12            DN         502                                                    652     |
|[210]                      [189]
B3/652 - ] [ - File #2 MAIN_PRGRM -  27,117,118
               File #3 CRYO_REGEN -  164,210,217,238
               File #6 TECH_RUNGS -  19
       -(L)- - File #3 CRYO_REGEN -  203
       -(U)- - File #3 CRYO_REGEN -  231
Rung #204
|
|                           ROR WAIT
|              CRYO 3       COMPRESSOR  CRYO 3                                                   COOL DOWN |
|ROUGHING      THERMCOUPL   3   60 SEC  TEMPERATUR                                               3         |
|AND ROR 3     50 MICRON    DONE        =<20K                                                    CD3       |
|R&ROR3        PIR5         C3RORTMR    CY3TMP20                                                   B3      |
|   B3            I:004        T4:33       B3                                                             |
|---] [-----------] [-----------] [---------]/[----------------------------------------------------(L)-----|
|   643           13            DN         503                                                    653     |
|[211]                      [190]
B3/653 - ] [ - File #2 MAIN_PRGRM -  28,119,120
               File #3 CRYO_REGEN -  165,211,218,239
               File #6 TECH_RUNGS -  19
       -(L)- - File #3 CRYO_REGEN -  204
       -(U)- - File #3 CRYO_REGEN -  232
Rung #205
|
|                           ROR WAIT
|              CRYO 5       COMPRESSOR  CRYO 5                                                   COOL DOWN |
|ROUGHING      THERMCOUPL   4   60 SEC  TEMPERATUR                                               4         |
|AND ROR 4     50 MICRON    DONE        =<20K                                                    CD4       |
|R&ROR4        PIR8         C4RORTMR    CY5TMP20                                                   B3      |
|   B3            I:024        T4:34       B3                                                             |
|---] [-----------] [-----------] [---------]/[----------------------------------------------------(L)-----|
|   644           11            DN         505                                                    654     |
|[212]                      [191]
B3/654 - ] [ - File #2 MAIN_PRGRM -  29,123,124
               File #3 CRYO_REGEN -  166,212,219,240
               File #6 TECH_RUNGS -  19
       -(L)- - File #3 CRYO_REGEN -  205
       -(U)- - File #3 CRYO_REGEN -  233
```

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```
Rung #206
|                                                ROR WAIT
|          CRYO 4      CRYO 6      CRYO 7      COMPRESSOR   CRYO 4
|ROUGHING  THERMCOUPL  THERMCOUPL  THERMCOUPL  5   60 SEC   TEMPERATUR                          COOL DOWN
|AND ROR 5 50 MICRON   50 MICRON   50 MICRON   DONE         =<20K                               5
|RERRORS   PIR7        PIR9        PIR12       C5RORTMR     CY4TMP20                            CD5
|  B3         I:024       I:024       I:040      T4:35        B3                                  B3
|---] [--------] [--------] [--------] [--------] [------+----]/[----+----------------------------(L)---
|  645          10          12          10         DN    |    504    |                            655
|[213]                                            [192]  |           |
|                                                        |           | B3/655 - ] [ - - File #2 MAIN_PRGRM - 30, 121, 122,
|                                                        |CRYO 6     |                  125, 126, 127, 128
|                                                        |TEMPERATUR |                  File #3 CRYO_REGEN - 167, 168, 169,
|                                                        |=<20K      |                  213, 220, 241
|                                                        |CY6TMP20   |                  File #6 TECH_RUNGS - 19
|                                                        |    B3     |           -(U)- - File #3 CRYO_REGEN - 234
|                                                        +----]/[----+
|                                                        |    506    |
|                                                        |CRYO 7     |
|                                                        |TEMPERATUR |
|                                                        |=<20K      |
|                                                        |CY7TMP20   |
|                                                        |    B3     |
|                                                        +----]/[----+
|                                                             507
Rung #207
                       ROR WAIT
          CRYO 8       COMPRESSOR  CRYO 8
|ROUGHING  THERMCOUPL  6   60 SEC  TEMPERATUR                                                   COOL DOWN
|AND ROR 6 50 MICRON   DONE        =<20K                                                        6
|RERROR6   PIR13       C6RORTMR    CY8TMP20                                                     CD6
|  B3         I:040      T4:36        B3                                                          B3
|---] [--------] [--------] [--------]/[----------------------------------------------------------(L)---
|  646          11         DN          508                                                        656
|[214]                   [193]
B3/656 - ] [ - - File #2 MAIN_PRGRM -  31,129,130
                 File #3 CRYO_REGEN -  170,214,221,242
                 File #6 TECH_RUNGS -  19
         -(L)- - File #3 CRYO_REGEN -  207
         -(U)- - File #3 CRYO_REGEN -  235
```

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Rung #208

ROUGHING AND ROR 7 R&ROR7 B3 647 [215]
CRYO 9 THERMCOUPL 50 MICRON PIR14 I:040 12
CRYO 10 THERMCOUPL 50 MICRON PIR18 I:054 11
CRYO 12 THERMCOUPL 50 MICRON PIR20 I:054 13
ROR WAIT COMPRESSOR 7 60 SEC DONE C7RORTMR T4:37 DN [194]
CRYO 9 TEMPERATUR =<20K CY9TMP20 B3 509
CRYO 10 TEMPERATUR =<20K CY10TMP20 B3 510
CRYO 12 TEMPERATUR =<20K CY12TMP20 B3 512
COOL DOWN 7 CD7 B3 -(L)- 657

B3/657 - ┤ ├ - File #2 MAIN_PRGRM - 32, 131, 132, 133, .134, 137, 138
File #3 CRYO_REGEN - 171, 172, 173, 215, 222, 243
File #6 TECH_RUNGS - 19
-(U)- - File #3 CRYO_REGEN - 236

Rung #209

ROUGHING AND ROR 8 R&ROR8 B3 648 [216]
CRYO 11 THERMCOUPL 50 MICRON PIR19 I:054 12
ROR WAIT COMPRESSOR 8 60 SEC DONE C8RORTMR T4:38 DN [195]
CRYO 11 TEMPERATUR =<20K CY11TMP20 B3 511
COOL DOWN 8 CD8 B3 -(L)- 658

B3/658 - ┤ ├ - File #2 MAIN_PRGRM - 33,135,136
File #3 CRYO_REGEN - 174,216,223,244
File #6 TECH_RUNGS - 19
-(L)- - File #3 CRYO_REGEN - 209
-(U)- - File #3 CRYO_REGEN - 237

Rung #210

COMPRESSOR 2 REGEN- ERATION PROGRAM CYRGN2 B3 322 [238]
PDM2 T4:42 TT [217]
COOL DOWN 2 CD2 B3 652 [203]
COMPRESSOR 2 REGEN- ERATION PROGRAM CYRGN2 B3 -|/|- 322 [238]
ROUGHING AND ROR 2 R&ROR2 B3 -(U)- 642

B3/642 - ┤ ├ - File #3 CRYO_REGEN - 135, 164, 175, 176, 189, 196, 203
File #6 TECH_RUNGS - 17
-(L)- - File #3 CRYO_REGEN - 128

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```
Rung #211
| COMPRESSOR
| 3 REGEN-
| ERATION             COOL DOWN                                              ROUGHING
| PROGRAM             3                                                      AND ROR 3
| CYRGN3     PDM3     CD3                                                    R&ROR3
|   B3       T4:43    B3                                                       B3
|-+--] [------] [------] [--+------------------------------------------------(U)---|
| |  323      TT       653  |                                                  643
| |[239]    [218]    [204]  |
| |                         | B3/643 - ] [ - File #3 CRYO_REGEN - 136, 165, 177, 178, 190, 197, 204
| |                         |              File #6 TECH_RUNGS - 17
| |COMPRESSOR               |        -(L)- - File #3 CRYO_REGEN - 129
| |3 REGEN-                 |
| |ERATION                  |
| |PROGRAM                  |
| |CYRGN3                   |
| |   B3                    |
| +--]/[--------------------+
|    323
|  [239]
Rung #212
| COMPRESSOR
| 4 REGEN-
| ERATION             COOL DOWN                                              ROUGHING
| PROGRAM             4                                                      AND ROR 4
| CYRGN4     PDM4     CD4                                                    R&ROR4
|   B3       T4:44    B3                                                       B3
|-+--] [------] [------] [--+------------------------------------------------(U)---|
| |  324      TT       654  |                                                  644
| |[240]    [219]    [205]  |
| |                         | B3/644 - ] [ - File #3 CRYO_REGEN - 137, 166, 179, 180, 191, 198, 205
| |                         |              File #6 TECH_RUNGS - 17
| |COMPRESSOR               |        -(L)- - File #3 CRYO_REGEN - 130
| |4 REGEN-                 |
| |ERATION                  |
| |PROGRAM                  |
| |CYRGN4                   |
| |   B3                    |
| +--]/[--------------------+
|    324
|  [240]
Rung #213
| COMPRESSOR
| 5 REGEN-
| ERATION             COOL DOWN                                              ROUGHING
| PROGRAM             5                                                      AND ROR 5
| CYRGN5     PDM5     CD5                                                    R&ROR5
|   B3       T4:45    B3                                                       B3
|-+--] [------] [------] [--+------------------------------------------------(U)---|
| |  325      TT       655  |                                                  645
| |[241]    [220]    [206]  |
| |                         | B3/645 - ] [ - File #3 CRYO_REGEN - 138, 167, 168, 169, 181, 182, 192, 199, 206
| |                         |              File #6 TECH_RUNGS - 17
| |COMPRESSOR               |        -(L)- - File #3 CRYO_REGEN - 131
| |5 REGEN-                 |
| |ERATION                  |
| |PROGRAM                  |
| |CYRGN5                   |
| |   B3                    |
| +--]/[--------------------+
|    325
|  [241]
```

```
Rung #214
| COMPRESSOR
| 6 REGEN-                                                                        ROUGHING
| ERATION            COOL DOWN                                                    AND ROR 6
| PROGRAM            6                                                            R&ROR6
| CYRGN6      PDM6   CD6                                                            B3
|     B3      T4:46    B3                                                        --(U)--
|----] [------] [------] [---------------------------------------------------------------
| |   326      TT      656  |                                                        646
| |[242]     [221]  [207]   |
| |                         | B3/646 - ] [ - File #3 CRYO_REGEN - 139, 170, 183, 184, 193, 200, 207
| |                         |             File #6 TECH_RUNGS - 17
| |COMPRESSOR               |       -(L)- - File #3 CRYO_REGEN - 132
| |6 REGEN-                 |
| |ERATION                  |
| |PROGRAM                  |
| |CYRGN6                   |
| |    B3                   |
| +---]/[-------------------+
|     326
|  [242]
Rung #215
| COMPRESSOR
| 7 REGEN-                                                                        ROUGHING
| ERATION            COOL DOWN                                                    AND ROR 7
| PROGRAM            7                                                            R&ROR7
| CYRGN7      PDM7   CD7                                                            B3
|     B3      T4:47    B3                                                        --(U)--
|----] [------] [------] [---------------------------------------------------------------
| |   327      TT      657  |                                                        647
| |[243]     [222]  [208]   |
| |                         | B3/647 - ] [ - File #3 CRYO_REGEN - 140, 171, 172, 173, 185, 186, 194, 201, 208
| |                         |             File #6 TECH_RUNGS - 17
| |COMPRESSOR               |       -(L)- - File #3 CRYO_REGEN - 133
| |7 REGEN-                 |
| |ERATION                  |
| |PROGRAM                  |
| |CYRGN7                   |
| |    B3                   |
| +---]/[-------------------+
|     327
|  [243]
Rung #216
| COMPRESSOR
| 8 REGEN-                                                                        ROUGHING
| ERATION            COOL DOWN                                                    AND ROR 8
| PROGRAM            8                                                            R&ROR8
| CYRGN8      PDM8   CD8                                                            B3
|     B3      T4:48    B3                                                        --(U)--
|----] [------] [------] [---------------------------------------------------------------
| |   328      TT      658  |                                                        648
| |[244]     [223]  [209]   |
| |                         | B3/648 - ] [ - File #3 CRYO_REGEN - 141, 174, 187, 188, 195, 202, 209
| |                         |             File #6 TECH_RUNGS - 17
| |COMPRESSOR               |       -(L)- - File #3 CRYO_REGEN - 134
| |8 REGEN-                 |
| |ERATION                  |
| |PROGRAM                  |
| |CYRGN8                   |
| |    B3                   |
| +---]/[-------------------+
|     328
|  [244]
```

545

Rung #217

```
|           CRYO 2                                            REGEN
|COOL DOWN  TEMPERATUR                                        TIME TO          |
|2          =<20K                                             20K  2           |
|CD2        CY2TMP20                                          PDM2             |
|  B3          B3                                             ┌─TON──────────┐ |
|──┤ ├────────┤/├─────────────────────────────────────────────┤TIMER ON DELAY├─(EN)─┤
|  652         502                                            |TIMER:   T4:42|       |
|[203]                                                        |BASE (SEC): 1.0├─(DN) |
|                                                             |PRESET:   7200|       |
|                                                             |ACCUM:       0|       |
|                                                             └──────────────┘       |
T4:42.DN - ┤ ├ - File #3 CRYO_REGEN -  32,252
T4:42.TT - ┤ ├ - File #3 CRYO_REGEN -  210
```

Rung #218

```
|           CRYO 3                                            REGEN            |
|COOL DOWN  TEMPERATUR                                        TIME TO          |
|3          =<20K                                             20K  3           |
|CD3        CY3TMP20                                          PDM3             |
|  B3          B3                                             ┌─TON──────────┐ |
|──┤ ├────────┤/├─────────────────────────────────────────────┤TIMER ON DELAY├─(EN)─┤
|  653         503                                            |TIMER:   T4:43|       |
|[204]                                                        |BASE (SEC): 1.0├─(DN) |
|                                                             |PRESET:   7200|       |
|                                                             |ACCUM:       0|       |
|                                                             └──────────────┘       |
:43.DN - ┤ ├ - File #3 CRYO_REGEN -  32,253
:43.TT - ┤ ├ - File #3 CRYO_REGEN -  211
```

Rung #219

```
|           CRYO 5                                            REGEN            |
|COOL DOWN  TEMPERATUR                                        TIME TO          |
|4          =<20K                                             20K  4           |
|CD4        CY5TMP20                                          PDM4             |
|  B3          B3                                             ┌─TON──────────┐ |
|──┤ ├────────┤/├─────────────────────────────────────────────┤TIMER ON DELAY├─(EN)─┤
|  654         505                                            |TIMER:   T4:44|       |
|[205]                                                        |BASE (SEC): 1.0├─(DN) |
|                                                             |PRESET:   7200|       |
|                                                             |ACCUM:       0|       |
|                                                             └──────────────┘       |
T4:44.DN - ┤ ├ - File #3 CRYO_REGEN -  32,254
T4:44.TT - ┤ ├ - File #3 CRYO_REGEN -  212
```

```
Rung #220
|                                                                      REGEN          |
|           CRYO 4                                                     TIME TO        |
|COOL DOWN  TEMPERATUR                                                 20K  5         |
|5          =<20K                                                      PDM5           |
|CD5        CY4TMP20                                                   +--TON--------+ |
|  B3          B3                                                      |TIMER ON DELAY|-(EN)-|
|---| |----+---|/|---+-------------------------------------------------|TIMER:  T4:45|      |
|  655     |   504   |                                                 |BASE (SEC): 1.0|-(DN)|
|[206]     |         |                                                 |PRESET:  7200|      |
|          |         | T4:45.DN - -| |- - File #3 CRYO_REGEN - 32, 255  |ACCUM:      0|      |
|          |CRYO 6   | T4:45.TT - -| |- - File #3 CRYO_REGEN - 213      +-------------+      |
|          |TEMPERATUR|                                                                    |
|          |=<20K    |                                                                     |
|          |CY6TMP20 |                                                                     |
|          |   B3    |                                                                     |
|          +---|/|---+                                                                     |
|          |   506   |                                                                     |
|          |CRYO 7   |                                                                     |
|          |TEMPERATUR|                                                                    |
|          |=<20K    |                                                                     |
|          |CY7TMP20 |                                                                     |
|          |   B3    |                                                                     |
|          +---|/|---+                                                                     |
|              507                                                                         |
Rung #221
|                                                                      REGEN          |
|           CRYO 8                                                     TIME TO        |
 OL DOWN    TEMPERATUR                                                 20K  6         |
|           =<20K                                                      PDM6           |
|CD6        CY8TMP20                                                   +--TON--------+ |
|  B3          B3                                                      |TIMER ON DELAY|-(EN)-|
|---| |--------|/|-----------------------------------------------------|TIMER:  T4:46|      |
|  656         508                                                     |BASE (SEC): 1.0|-(DN)|
|[207]                                                                 |PRESET:  7200|      |
|                                                                      |ACCUM:      0|      |
|                                                                      +-------------+      |
T4:46.DN - -| |- - File #3 CRYO_REGEN -  32,256
T4:46.TT - -| |- - File #3 CRYO_REGEN -  214
Rung #222
|                                                                      REGEN          |
|           CRYO 9                                                     TIME TO        |
|COOL DOWN  TEMPERATUR                                                 20K  7         |
|7          =<20K                                                      PDM7           |
|CD7        CY9TMP20                                                   +--TON--------+ |
|  B3          B3                                                      |TIMER ON DELAY|-(EN)-|
|---| |----+---|/|---+-------------------------------------------------|TIMER:  T4:47|      |
|  657     |   509   |                                                 |BASE (SEC): 1.0|-(DN)|
|[208]     |         |                                                 |PRESET:  7200|      |
|          |         | T4:47.DN - -| |- - File #3 CRYO_REGEN - 32, 257  |ACCUM:      0|      |
|          |CRYO 10  | T4:47.TT - -| |- - File #3 CRYO_REGEN - 215      +-------------+      |
|          |TEMPERATUR|                                                                    |
|          |=<20K    |                                                                     |
|          |CY10TMP20|                                                                     |
|          |   B3    |                                                                     |
|          +---|/|---+                                                                     |
|          |   510   |                                                                     |
|          |CRYO 12  |                                                                     |
|          |TEMPERATUR|                                                                    |
|          |=<20K    |                                                                     |
|          |CY12TMP20|                                                                     |
|          |   B3    |                                                                     |
|          +---|/|---+                                                                     |
|              512                                                                         |
```

```
Rung #223
|                                                                      REGEN           |
|COOL DOWN   CRYO 11                                                   TIME TO         |
|8           TEMPERATUR                                                20K  8          |
|CD8         =<20K                                                     PDN8            |
|            CY11TMP20                                                 ┌─TON────────┐  |
|  B3          B3                                                      |TIMER ON DELAY├(EN)┤
├──┤ ├───────┤/├───────────────────────────────────────────────────────┤TIMER:   T4:48|  |
|  658         511                                                     |BASE (SEC): 1.0├(DN)|
|[209]                                                                 |PRESET:   7200|  |
|                                                                      |ACCUM:       0|  |
|                                                                      └──────────────┘  |
T4:48.DN - ┤ ├ - File #3 CRYO_REGEN - 32,258
T4:48.TT - ┤ ├ - File #3 CRYO_REGEN - 216
```

```
BASE :  Rung #224
| COMPRESSOR  CRYO 2                                                  REROUGH     |
| 2 REGEN-    COUNTER                                                 COUNTER     |
| ERATION     RESET                                                   COMPRESSOR  |
| PROGRAM     ONE SHOT                                                2           |
| CYRGN2      C2CROS                                                  C2RERUF     |
|      B3          B3                                                    C5:2     |
├─┬───┤/├────────[ONS]─┬──────────────────────────────────────────────(RES)──────┤
| |    322         562  |                                                          |
| [238]                 | C5:2 - CTU - File #3 CRYO_REGEN - 196                    |
|                       | C5:2.DN - ┤ ├ - File #2 MAIN_PRGRM - 624                 |
| |PAUSE                |                                                          |
| |DISABLE              |                                                          |
| |TS12                 |                                                          |
| | N7:16               |                                                          |
| └──┤ ├────────────────┘                                                          |
|      4                                                                           |
| [2:3]                                                                            |
```

BASE : Rung #225

```
| COMPRESSOR  CRYO 3                                                              REROUGH    |
| 3 REGEN-    COUNTER                                                             COUNTER    |
| ERATION     RESET                                                               COMPRESSOR |
| PROGRAM     ONE SHOT                                                            3          |
| CYRGN3      C3CROS                                                              C3RERUF    |
|        B3        B3                                                                 C5:3   |
|-+----]/[------[ONS]-+-------------------------------------------------------------(RES)---|
| |      323       563 |                                                                     |
| |[239]               |                                                                     |
| |                    | C5:3 - CTU - File #3 CRYO_REGEN - 197                               |
| |                    | C5:3.DN - ] [ - File #2 MAIN_PRGRM - 624                            |
| |PAUSE               |                                                                     |
| |DISABLE             |                                                                     |
| |TS12                |                                                                     |
| |  N7:16             |                                                                     |
| +----] [-------------+                                                                     |
|       4                                                                                    |
|  [2:3]
```

```
BASE :   Rung #226
| COMPRESSOR  CRYO 4                                                          REROUGH     |
| 4 REGEN-    COUNTER                                                         COUNTER     |
| ERATION     RESET                                                           COMPRESSOR  |
| PROGRAM     ONE SHOT                                                        4.          |
| CYRGN4      C4CROS                                                          C4RERUF     |
|       B3          B3                                                           C5:4     |
|-+----]/[-------[ONS]-+---------------------------------------------------------[RES]----|
| |      324        564 |                                                                 |
| |[240]                |                                                                 |
| |                     | C5:4 - CTU - File #3 CRYO_REGEN - 198                           |
| |                     | C5:4.DN - ] [ - File #2 MAIN_PRGRM - 624                        |
| |PAUSE                |                                                                 |
| |DISABLE              |                                                                 |
| |TS12                 |                                                                 |
| |  N7:16              |                                                                 |
| +----] [--------------+                                                                 |
|       4                                                                                 |
|  [2:3]                                                                                  |
```

```
BASE :  Rung #227
| COMPRESSOR  CRYO 5                                                    REROUGH    |
| 5 REGEN-    COUNTER                                                   COUNTER    |
| ERATION     RESET                                                     COMPRESSOR |
| PROGRAM     ONE SHOT                                                  5          |
| CYRGN5      C5CROS                                                    C5RERUF    |
|     B3          B3                                                       C5:5    |
|-+----]/[------[ONS]--+---------------------------------------------------(RES)----|
| |   325         565  |                                                           |
| |[241]               |                                                           |
| |                    | C5:5 - CTU - File #3 CRYO_REGEN - 199                     |
| |                    | C5:5.DN - ] [ - File #2 MAIN_PRGRM - 624                  |
| |PAUSE               |                                                           |
| |DISABLE             |                                                           |
| |TS12                |                                                           |
| |  N7:16             |                                                           |
| +----] [-------------+                                                           |
|      4                                                                           |
|  [2:3]
```

BASE : Rung #228

```
| COMPRESSOR  CRYO 6                                          REROUGH    |
| 6 REGEN-    COUNTER                                         COUNTER    |
| ERATION     RESET                                           COMPRESSOR |
| PROGRAM     ONE SHOT                                        6          |
| CYRGN6      C6CROS                                          C6R3RUF    |
|     B3         B3                                              C5:6   |
|-+---]/[------[ONS]-+------------------------------------------(RES)---|
| |   326        566 |                                                   |
| |[242]             |                                                   |
| |                  | C5:6 - CTU - File #3 CRYO_REGEN - 200             |
| |                  | C5:6.DN - -| |- - File #2 MAIN_PRGRM - 624        |
| |PAUSE             |                                                   |
| |DISABLE           |                                                   |
| |TS12              |                                                   |
| |  N7:16           |                                                   |
| +---] [------------+                                                   |
|      4                                                                 |
|  [2:3]                                                                 |
```

```
BASE :   Rung #229
| COMPRESSOR  CRYO 7                                                              REROUGH     |
| 7 REGEN-    COUNTER                                                             COUNTER     |
| ERATION     RESET                                                               COMPRESSOR  |
| PROGRAM     ONE SHOT                                                            7           |
| CYRGN7      C7CROS                                                              C7RERUF     |
|       B3          B3                                                                C5:7    |
|-+----]/[---------[ONS]-+-----------------------------------------------------------[RES]----|
| |     327         567  |                                                                    |
| |[243]                 |                                                                    |
| |                      | C5:7 - CTU - File #3 CRYO_REGEN - 201                              |
| |                      | C5:7.DN - ] [ - File #2 MAIN_PRGRM - 624                           |
| |                      |                                                                    |
| |PAUSE                 |                                                                    |
| |DISABLE               |                                                                    |
| |TS12                  |                                                                    |
| |  N7:16               |                                                                    |
| +---] [----------------+                                                                    |
|      4                                                                                      |
|  [2:3]
```

```
BASE :  Rung #230
|  COMPRESSOR  CRYO 8                                              REROUGH     |
|  8 REGEN-    COUNTER                                             COUNTER     |
|  ERATION     RESET                                               COMPRESSOR  |
|  PROGRAM     ONE SHOT                                            8           |
|  CYRGN8      C8CROS                                              C8RERUF     |
|        B3          B3                                                C5:8    |
|-+----|/|-------[ONS]--+---------------------------------------------[RES]----|
| |    328         568  |                                                      |
| |[244]                |                                                      |
| |                     | C5:8 - CTU - File #3 CRYO_REGEN - 202                |
| |                     | C5:8.DN - -| |- - File #2 MAIN_PRGRM - 624           |
| |PAUSE                |                                                      |
| |DISABLE              |                                                      |
| |TS12                 |                                                      |
| |  N7:16              |                                                      |
| +----| |--------------+                                                      |
|       4                                                                      |
|  [2:3]                                                                       |
```

```
Rung #231
|COMPRESSOR                                                                    |
|2 REGEN-                                                                      |
|ERATION                                                           COOL DOWN   |
|PROGRAM                                                           2           |
|CYRGN2                                                            CD2         |
|      B3                                                              B3      |
|  ---|/|-------------------------------------------------------------(U)------|
|     322                                                              652     |
|[238]                                                                         |
B3/652 - -| |- - File #2 MAIN_PRGRM -  27,117,118
                 File #3 CRYO_REGEN -  164,210,217,238
                 File #6 TECH_RUNGS -  19
        -(L)- - File #3 CRYO_REGEN -  203
        -(U)- - File #3 CRYO_REGEN -  231
```

```
Rung #232
|COMPRESSOR                                                          |
|3 REGEN-                                                  COOL DOWN |
|ERATION                                                   3         |
|PROGRAM                                                   CD3       |
|CYRGN3                                                      B3      |
|    B3                                                              |
|----|/|------------------------------------------------------(U)----|
|    323                                                     653     |
|[239]
B3/653 - -| |- - File #2 MAIN_PRGRM -   28,119,120
                 File #3 CRYO_REGEN -   165,211,218,239
                 File #6 TECH_RUNGS -   19
         -(L)- - File #3 CRYO_REGEN -   204
         -(U)- - File #3 CRYO_REGEN -   232
Rung #233
|COMPRESSOR                                                          |
|4 REGEN-                                                  COOL DOWN |
|ERATION                                                   4         |
|PROGRAM                                                   CD4       |
|CYRGN4                                                      B3      |
|    B3                                                              |
|----|/|------------------------------------------------------(U)----|
|    324                                                     654     |
|[240]
B3/654 - -| |- - File #2 MAIN_PRGRM -   29,123,124
                 File #3 CRYO_REGEN -   166,212,219,240
                 File #6 TECH_RUNGS -   19
         -(L)- - File #3 CRYO_REGEN -   205
         -(U)- - File #3 CRYO_REGEN -   233
Rung #234
|COMPRESSOR                                                          |
|5 REGEN-                                                  COOL DOWN |
|ERATION                                                   5         |
|PROGRAM                                                   CD5       |
|CYRGN5                                                      B3      |
|    B3                                                              |
|----|/|------------------------------------------------------(U)----|
|    325                                                     655     |
|[241]
B3/655 - -| |- - File #2 MAIN_PRGRM -   30,121,122,125,126,127,128
                 File #3 CRYO_REGEN -   167,168,169,213,220,241
                 File #6 TECH_RUNGS -   19
         -(L)- - File #3 CRYO_REGEN -   206
         -(U)- - File #3 CRYO_REGEN -   234
Rung #235
|COMPRESSOR                                                          |
|6 REGEN-                                                  COOL DOWN |
|ERATION                                                   6         |
|PROGRAM                                                   CD6       |
|CYRGN6                                                      B3      |
|    B3                                                              |
|----|/|------------------------------------------------------(U)----|
|    326                                                     656     |
|[242]
B3/656 - -| |- - File #2 MAIN_PRGRM -   31,129,130
                 File #3 CRYO_REGEN -   170,214,221,242
                 File #6 TECH_RUNGS -   19
         -(L)- - File #3 CRYO_REGEN -   207
         -(U)- - File #3 CRYO_REGEN -   235
```

Rung #236

```
|COMPRESSOR                                                                 |
|7 REGEN-                                                        COOL DOWN  |
|ERATION                                                         7          |
|PROGRAM                                                         CD7        |
|CYRGN7                                                             B3      |
|      B3                                                                   |
|----]/[------------------------------------------------------------(U)-----|
|     327                                                            657     |
|[243]                                                                      |
B3/657 - ] [ - File #2 MAIN_PRGRM -  32,131,132,133,134,137,138
               File #3 CRYO_REGEN -  171,172,173,215,222,243
               File #6 TECH_RUNGS -  19
        -(L)- - File #3 CRYO_REGEN -  208
        -(U)- - File #3 CRYO_REGEN -  236
```

Rung #237

```
|COMPRESSOR                                                                 |
|8 REGEN-                                                                   |
|ERATION                                                         COOL DOWN  |
|PROGRAM                                                         8          |
|CYRGN8                                                          CD8        |
|      B3                                                           B3      |
|----]/[------------------------------------------------------------(U)-----|
|     328                                                            658     |
|[244]                                                                      |
B3/658 - ] [ - File #2 MAIN_PRGRM -  33,135,136
               File #3 CRYO_REGEN -  174,216,223,244
               File #6 TECH_RUNGS -  19
        -(L)- - File #3 CRYO_REGEN -  209
        -(U)- - File #3 CRYO_REGEN -  237
```

Rung #238

```
|                                                                          COMPRESSOR
|              CRYO 2                                                      2 REGEN-
| COOL DOWN    TEMPERATUR                                                  ERATION
| 2            =<20K                                                       PROGRAM
| CD2          CY2TMP20                                                    CYRGN2
|    B3           B3                                                          B3
|---] [---------] [---+----------------------------------------------------+--(U)--+
|    652          502 |                                                    |  322   |
| [231]               | B3/322 - ] [ - File #2 MAIN_PRGRM - 110, 117, 118, 460, 462 |
|                     |            File #3 CRYO_REGEN - 35, 37, 67, 74, 210, 245, 252,
|                     |            259                                     |MANUAL
|                     |            File #6 TECH_RUNGS - 14                 |COMPRESSOR 2
|ABORT CRYO  REGENERATE      ]/[ - File #2 MAIN_PRGRM - 27, 117, 118       |REGENERATION
|TIMER       CRYO 2   |            File #3 CRYO_REGEN - 33, 117, 135, 143, 176, 210, 224,
|ABORTCRYO   TS02     |            231                                     |ENABLE
|  T4:297     N7:15   |      -(L)- - File #3 CRYO_REGEN - 34               |MC2RE
|---] [---+---] [---+-+ N7:36/10 - -(L)- - File #3 CRYO_REGEN - 34         |  N7:36
|    TT   |    10   | | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2        +--(U)--+
| [27]    |[2:3]    | |                                                       10
|         |REGENERATE |
|         |ALL CRYO'S |
|         |TS20     | |
|         |  N7:16  | |
|         +---] [---+ |
|              12     |
|            [2:3]    |
|PIRANI               |
|GUAGE 2              |
|NO FAULT             |
|PGNF2                |
|  I:004              |
|---]/[---------------+
|    15               |
|CRYO RE-             |
|GENERATION           |
|FAULT                |
|COMPRESSOR           |
|2                    |
|CRFLT2               |
|    B3               |
|---] [---------------+
|    332              |
|[252]                |
|PREPARE FOR          |
|AUTO RUN             |
|>AUTO                |
|   N7:37             |
|---] [---------------+
|     1
| [2:157]
```

Rung #239

```
                                                                              COMPRESSOR
            CRYO 3                                                            3 REGEN-
 COOL DOWN  TEMPERATUR                                                        ERATION
 3          =<20K                                                             PROGRAM
 CD3        CY3TMP20                                                          CYRGN3
   B3         B3                                                                 B3
--] [--------] [---------------------------------------------------------------(U)--
   653        503                                                                323
 [232]
                         B3/323 - ] [ - File #2 MAIN_PRGRM - 111, 119, 120, 464, 466   MANUAL
                                        File #3 CRYO_REGEN - 39, 41, 68, 75, 211, 246, 253,   COMPRESSOR 3
                                        259                                            REGENERATION
                                        File #6 TECH_RUNGS - 14                        ENABLE
 ABORT CRYO    REGENERATE          ]/[ - File #2 MAIN_PRGRM - 28, 119, 120             MC3RE
 TIMER         CRYO 3                   File #3 CRYO_REGEN - 33, 118, 136, 145, 178, 211, 225,   N7:36
 ABORTCRYO     TS03                     232                                            --(U)--
   T4:297        N7:15             -(L)- - File #3 CRYO_REGEN - 38                        11
--] [-----------] [-----   N7:36/11 - -(L)- - File #3 CRYO_REGEN - 38
    TT            11       _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2
 [27]          [2:3]
               REGENERATE
               ALL CRYO'S
               TS20
                 N7:16
              ---] [---
                  12
               [2:3]
 PIRANI
 GUAGE 2
 NO FAULT
 PGNF2
   I:004
--]/[--
   15
 CRYO RE-
 GENERATION
 FAULT
 COMPRESSOR
 3
 CRFLT3
   B3
--] [--
   333
 [253]
 PREPARE FOR
 AUTO RUN
 >AUTO
   N7:37
--] [--
    1
 [2:157]
```

Rung #240

```
|                                                                                    COMPRESSOR
|               CRYO 5                                                               4 REGEN-
| COOL DOWN     TEMPERATUR                                                           ERATION
| 4             =<20K                                                                PROGRAM
| CD4           CY5TMP20                                                             CYRGN4
|     B3            B3                                                                  B3
|----] [-------] [--------------------------------------------------------------------(U)----
|     654           505                                                                 324
| [233]
|                           B3/324 - ] [ - File #2 MAIN_PRGRM - 111, 123, 124, 470, 472, 474
|                                          File #3 CRYO_REGEN - 43, 45, 69, 76, 212, 247, 254,
|                                          259
|                                          File #6 TECH_RUNGS - 14
|                                   ]/[ - File #2 MAIN_PRGRM - 29, 123, 124
|                                          File #3 CRYO_REGEN - 33, 119, 137, 149, 180, 212, 226,
|                                          233
|                                  -(L)- - File #3 CRYO_REGEN - 42
|                           N7:36/12 - -(L)- - File #3 CRYO_REGEN - 42
|                           _F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2
|
|ABORT CRYO    REGENERATE                                                           MANUAL
|TIMER         CRYO 4                                                               COMPRESSOR 4
|ABORTCRYO     TS04                                                                 REGENERATION
|  T4:297        N7:15                                                              ENABLE
|----] [--------] [----                                                             MC4RE
|     TT           12                                                                  N7:36
|[27]          [2:3]                                                                ---(U)---
|              REGENERATE                                                               12
|              ALL CRYO'S
|              TS20
|                N7:16
|              ---] [---
|                   12
|              [2:3]
|PIRINI
|GUAGE 4
|NO FAULT
|PGNF4
|  I:024
|----]/[------
|     15
|CRYO RE-
|GENERATION
|FAULT
|COMPRESSOR
|4
|CRFLT4
|     B3
|----] [------
|     334
|[254]
|PREPARE FOR
|AUTO RUN
|>AUTO
|    N7:37
|----] [------
|     1
| [2:157]
```

559

Rung #241

```
COOL DOWN 5 CD5          B3 655  [234]
CRYO 4 TEMPERATUR =<20K CY4TMP20   B3 504
CRYO 6 TEMPERATUR =<20K CY6TMP20   B3 506
CRYO 7 TEMPERATUR =<20K CY7TMP20   B3 507
ABORT CRYO TIMER ABORTCRYO   T4:297 TT  [27]
REGENERATE CRYO 5 TS05   N7:15 13  [2:3]
REGENERATE ALL CRYO'S TS20   N7:16 12  [2:3]
PIRINI GUAGE 3 NO FAULT PGNF3   I:024 -|/|- 14
PIRINI GUAGE 4 NO FAULT PGNF4   I:024 -|/|- 15
PIRINI GUAGE 5 NO FAULT PGNF5   I:040 -|/|- 14
CRYO RE-GENERATION FAULT COMPRESSOR 5 CRFLT5   B3 335  [255]
PREPARE FOR

COMPRESSOR 5 REGEN-ERATION PROGRAM CYRGN5   B3 -(U)- 325
MANUAL COMPRESSOR 5 REGENERATION ENABLE MC5RE   N7:36 -(U)- 13

B3/325 - -| |- - File #2 MAIN_PRGRM - 111, 112, 121, 122,
                 125, 126, 127, 128, 468, 476, 478,
                 480, 482
                 File #3 CRYO_REGEN - 47, 51, 70, 77,
                 213, 248, 255, 259
                 File #6 TECH_RUNGS - 14
         -|/|- - File #2 MAIN_PRGRM - 30, 121, 122, 125,
                 126, 127, 128
                 File #3 CRYO_REGEN - 33, 120, 121, 122,
                 138, 147, 151, 153, 182, 213, 227,
                 234
         -(L)- - File #3 CRYO_REGEN - 46
N7:36/13 - -(L)- - File #3 CRYO_REGEN - 46
_F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2
```

560

```
< <                                          <
| |AUTO RUN                                  |
| |>AUTO                                     |
| |   N7:37                                  |
| └───┤ ├────────────────────────────────────┘
|       1
| [2:157]
Rung #242
|                                                                                          COMPRESSOR
|                                                                                          6 REGEN-
|         CRYO 8                                                                           ERATION
| COOL DOWN TEMPERATUR                                                                     PROGRAM
| 6       =<20K                                                                            CYRGN6
| CD6     CY8TMP20                                                                           B3
|    B3      B3                                                                            ─(U)─
├──┤ ├────┤ ├──┬───────────────────────────────────────────────────────────────────────────┬──────┐
| | 656     508 |                                                                          |  326 |
| |[235]        |                                                                          |      |
| |             | B3/326 - ┤ ├ - File #2 MAIN_PRGRM - 112, 129, 130, 484, 486              |MANUAL
| |             |                File #3 CRYO_REGEN - 54, 56, 71, 78, 214, 249, 256,       |COMPRESSOR 6
| |             |                259                                                       |REGENERATION
| |             |                File #6 TECH_RUNGS - 14                                   |ENABLE
| |ABORT CRYO  REGENERATE  ┤/├ - File #2 MAIN_PRGRM - 31, 129, 130                         |MC6RE
| |TIMER       CRYO 6    |       File #3 CRYO_REGEN - 33, 123, 139, 155, 184, 214, 228,    |  N7:36
| |ABORTCRYO   TS06      |       235                                                       └──(U)──
| |  T4:297     N7:15    |  ─(L)─ - File #3 CRYO_REGEN - 52, 53                                14
| ├───┤ ├──────┤ ├───────┤ N7:36/14 - ─(L)─ - File #3 CRYO_REGEN - 52, 53
| |    TT   |   14    |  | _F:N7:21[X21 - BTW - File #2 MAIN_PRGRM - 2
| [27]      |[2:3]    |  |
| |         |REGENERATE| |
| |         |ALL CRYO'S| |
| |         |TS20     |  |
| |         |  N7:16  |  |
| |         └───┤ ├───┘  |
| |              12      |
| |          [2:3]       |
| |PIRINI                |
| |GUAGE 6               |
| |NO FAULT              |
| |PGNF6                 |
| |  I:040               |
| ├───┤/├────────────────┤
| |    15                |
| |CRYO RE-              |
| |GENERATION            |
| |FAULT                 |
| |COMPRESSOR            |
| |6                     |
| |CRFLT6                |
| |   B3                 |
| ├───┤ ├────────────────┤
| |   336                |
| |[256]                 |
| |PREPARE FOR           |
| |AUTO RUN              |
| |>AUTO                 |
| |   N7:37              |
| └───┤ ├────────────────┘
|      1
| [2:157]
```

561

Rung #243

```
COOL DOWN 7 CD7      CRYO 9 TEMPERATUR =<20K CY9TMP20   CRYO 10 TEMPERATUR =<20K CY10TMP20   CRYO 12 TEMPERATUR =<20K CY12TMP20      COMPRESSOR 7 REGEN-ERATION PROGRAM CYRGN7
B3 657 [236]         B3 509                              B3 510                               B3 512                                  B3 -(U)- 327

ABORT CRYO TIMER ABORTCRYO  T4:297 TT [27]
REGENERATE CRYO 7 TS07  N7:15 15 [2:3]
REGENERATE ALL CRYO'S TS20  N7:16 12 [2:3]
PIRINI GUAGE 6 NO FAULT PGNF6  I:040 -|/|- 15
PIRINI GUAGE 8 NO FAULT PGNF8  I:054 -|/|- 15
CRYO RE-GENERATION FAULT COMPRESSOR CRFLT7  B3 337 [257]
PREPARE FOR AUTO RUN >AUTO  N7:37 1 [2:157]

MANUAL COMPRESSOR 7 REGENERATION ENABLE MC7RE  N7:36 -(U)- 15

B3/327 - -| |- - File #2 MAIN_PRGRM - 113, 114, 131, 132,
                  133, 134, 137, 138, 488, 490, 492,
                  494, 500, 502
                  File #3 CRYO_REGEN - 58, 62, 72, 79,
                  215, 250, 257, 259
                  File #6 TECH_RUNGS - 14
         -|/|- - File #2 MAIN_PRGRM - 32, 131, 132, 133,
                  134, 137, 138
                  File #3 CRYO_REGEN - 33, 124, 125, 126,
                  140, 157, 159, 163, 186, 215, 229,
                  236
         -(L)- - File #3 CRYO_REGEN - 57
N7:36/15 - -(L)- - File #3 CRYO_REGEN - 57
_F:N7:211X21 - BTW - File #2 MAIN_PRGRM - 2
```

562

```
Rung #244
                                                                  COMPRESSOR
        CRYO 11                                                   8 REGEN-
COOL DOWN  TEMPERATUR                                             ERATION
8       =<20K                                                     PROGRAM
CD8     CY11TMP20                                                 CYRGM8
  B3      B3                                                        B3
--] [-----] [----------------------------------------------------(U)--
 658     511                                                        328
[237]
          B3/328 - ] [ - File #2 MAIN_PRGRM - 113, 135, 136, 496, 498       MANUAL
                         File #3 CRYO_REGEN - 64, 66, 73, 80, 216, 251, 258,   COMPRESSOR 8
                         259                                                  REGENERATION
                         File #6 TECH_RUNGS - 14                              ENABLE
                  ]/[ - File #2 MAIN_PRGRM - 33, 135, 136                     MC8RE
ABORT CRYO   REGENERATE   File #3 CRYO_REGEN - 33, 127, 141, 161, 188, 216, 230,   N7:37
TIMER        CRYO 8       237                                               --(U)--
ABORTCRYO    TS08       -(L)- - File #3 CRYO_REGEN - 63                        0
  T4:297      N7:16
--] [-------] [------- N7:37/0 - -(L)- - File #3 CRYO_REGEN - 63
   TT          0       _F:N7:21LX21 - BTW - File #2 MAIN_PRGRM - 2
[27]         [2:3]
             REGENERATE
             ALL CRYO'S
             TS20
               N7:16
             --] [--
                12
             [2:3]
PIRINI
GUAGE 8
NO FAULT
PGNF8
  I:054
--]/[-----
   15
CRYO RE-
GENERATION
FAULT
COMPRESSOR
8
CRFLT8
   B3
--] [-----
  338
[258]
PREPARE FOR
AUTO RUN
>AUTO
   N7:37
--] [-----
    1
[2:157]
```

```
Rung #245
|COMPRESSOR  HEATER 2                                                         |
|2 REGEN-    CHAMBER                                    CRYO REGEN            |
|ERATION     GATE VALVE                                 COMPRESSOR            |
|PROGRAM     CLOSE                                      2 HV2 FAULT           |
|CYRGN2      HV2S1                                      CR2FLT                |
|   B3         I:004                                   +-TON-------------+    |
|---] [--------]/[--------------------------------------+TIMER ON DELAY   +-(EN)-|
|   322        00                                      |TIMER:     T4:12|     |
|[238]                                                 |BASE (SEC):  1.0+-(DN) |
|                                                      |PRESET:       30|     |
|                                                      |ACCUM:         0|     |
|                                                      +-----------------+    |
T4:12.DN - ] [ - File #3 CRYO_REGEN - 252
Rung #246
|COMPRESSOR  DWELL 1                                                          |
|3 REGEN-    CHAMBER                                    CRYO REGEN            |
|ERATION     GATE VALVE                                 COMPRESSOR            |
|PROGRAM     CLOSED                                     3 HV3 FAULT           |
|CYRGN3      HV3S1                                      CR3FLT                |
|   B3         I:004                                   +-TON-------------+    |
|---] [--------]/[--------------------------------------+TIMER ON DELAY   +-(EN)-|
|   323        03                                      |TIMER:     T4:13|     |
|[239]                                                 |BASE (SEC):  1.0+-(DN) |
|                                                      |PRESET:       30|     |
|                                                      |ACCUM:         0|     |
|                                                      +-----------------+    |
  13.DN - ] [ - File #3 CRYO_REGEN - 253
Rung #247
|COMPRESSOR  HEATER 3                                                         |
|4 REGEN-    CHAMBER                                    CRYO REGEN            |
|ERATION     GATE VALVE                                 COMPRESSOR            |
|PROGRAM     CLOSED                                     4 HV5 FAULT           |
|CYRGN4      HV5S1                                      CR5FLT                |
|   B3         I:024                                   +-TON-------------+    |
|---] [--------]/[--------------------------------------+TIMER ON DELAY   +-(EN)-|
|   324        00                                      |TIMER:     T4:14|     |
|[240]                                                 |BASE (SEC):  1.0+-(DN) |
|                                                      |PRESET:       30|     |
|                                                      |ACCUM:         0|     |
|                                                      +-----------------+    |
T4:14.DN - ] [ - File #3 CRYO_REGEN - 254
```

```
Rung #248
|COMPRESSOR    DWELL 2                                                    CRYO REGEN
|5 REGEN-      CHAMBER                                                    COMPRESSOR
|ERATION       GATE VALVE                                                 5 HV4,6,7 FAULT
|PROGRAM       CLOSED                                                     CR467FLT
|CYRGN5        HV4S1                                                      +--TON-----------------+
|    B3           I:022                                                   |TIMER ON DELAY        +-(EN)-
+----] [------+-----]/[---+---------------------------------------------+TIMER:         T4:15|
|    325      |     06    |                                               |BASE (SEC):     1.0+-(DN)
|[241]        |           |                                               |PRESET:          30|
|             |DWELL 3    | T4:15.DN - ] [ - File #3 CRYO_REGEN - 255     |ACCUM:            0|
|             |CHAMBER    |                                               +---------------------+
|             |GATE VALVE |
|             |CLOSED     |
|             |HV6S1      |
|             |   I:024   |
|             +----]/[----+
|             |    03     |
|             |DWELL 4    |
|             |CHAMBER    |
|             |GATE VALVE |
|             |CLOSED     |
|             |HV7S1      |
|             |   I:036   |
|             +----]/[----+
|                  06
Rung #249
 COMPRESSOR    BUFFER 3                                                   CRYO REGEN
|6 REGEN-      CHAMBER                                                    COMPRESSOR
|ERATION       GATE VALVE                                                 6 HV8 FAULT
|PROGRAM       CLOSED                                                     CR8FLT
|CYRGN6        HV8S1                                                      +--TON-----------------+
|    B3          I:040                                                    |TIMER ON DELAY        +-(EN)-
+----] [---------]/[------------------------------------------------------+TIMER:         T4:16|
|    326         00                                                       |BASE (SEC):     1.0+-(DN)
|[242]                                                                    |PRESET:          30|
|                                                                         |ACCUM:            0|
|                                                                         +---------------------+
|
T4:16.DN - ] [ - File #3 CRYO_REGEN - 256
```

Rung #250

```
|COMPRESSOR     DWELL 5                                                                            |
|7 REGEN-       CHAMBER                                                     CRYO REGEN             |
|ERATION        GATE VALVE                                                  COMPRESSOR             |
|PROGRAM        CLOSED                                                      7 HV91012 FAULT        |
|CYRGN7         HV9S1                                                       CR91012FLT.            |
|    B3            I:040                                                    +--TON------------+    |
|----] [--------+---]/[---+-------------------------------------------------+TIMER ON DELAY   +-(EN)-|
|   327         |    03   |                                                 |TIMER:      T4:17|    |
|[243]          |         |                                                 |BASE (SEC):  1.0 +-(DN) |
|               |DWELL 6  | T4:17.DN - ] [ - File #3 CRYO_REGEN - 257       |PRESET:       30 |    |
|               |CHAMBER  |                                                 |ACCUM:         0 |    |
|               |GATE VALVE                                                 +-----------------+    |
|               |CLOSED   |                                                                        |
|               |HV10S1   |                                                                        |
|               |   I:052 |                                                                        |
|               +---]/[---+                                                                        |
|               |    06   |                                                                        |
|               |EXITLOCK |                                                                        |
|               |CHAMBER  |                                                                        |
|               |GATE VALVE                                                                        |
|               |CLOSED   |                                                                        |
|               |HV12S1   |                                                                        |
|               |   I:054 |                                                                        |
|               +---]/[---+                                                                        |
|                   03                                                                             |
```

Rung #251

```
 MPRESSOR    BUFFER 4                                                                            |
|- REGEN-     CHAMBER                                                      CRYO REGEN             |
|ERATION      GATE VALVE                                                   COMPRESSOR             |
|PROGRAM      CLOSED                                                       8 HV11 FAULT           |
|CYRGN8       HV11S1                                                       CR11FLT                |
|    B3         I:054                                                      +--TON------------+    |
|----] [----------]/[------------------------------------------------------+TIMER ON DELAY   +-(EN)-|
|   328          00                                                        |TIMER:      T4:18|    |
|[244]                                                                     |BASE (SEC):  1.0 +-(DN) |
|                                                                          |PRESET:       30 |    |
|                                                                          |ACCUM:         0 |    |
|                                                                          +-----------------+    |
T4:18.DN - ] [ - File #3 CRYO_REGEN - 258
```

566

```
Rung #252
                                                                                   CRYO RE-
 COMPRESSOR    COOL DOWN                                                           GENERATION
 2 REGEN-      AFTER CRYO                                                          FAULT
 ERATION       REGEN                                                               COMPRESSOR
 PROGRAM       CRYO 2                                                              2
 CYRGN2        2 HOUR                                                              CRFLT2
               POM2                                                                  B3
   B3            T4:42
|--] [------+----] [----------+-------------------------------------------------------( )---|
   322      |    DN           |                                                      332
 [238]      | [217]           | B3/332 - ] [ - File #3 CRYO_REGEN - 238
            |                 |                File #6 TECH_RUNGS - 16
            | HIVAC 2         |
            | 10 SEC          |
            | TIMER           |
            | COMPETE         |
            | CR2FLT          |
            |   T4:12         |
            +----] [----------+
            |    DN           |
            | [245]           |
            | PURGE TIME      |
            | MONITOR         |
            | COMPRESSOR 2          N2 FLOW SWITCH
            | 5 SECOND TEST         2
            | PGC2                  NIFS2
            | +-GEQ---------------------+    I:002   |
            +-|GRTR THAN OR EQUAL (A>=B)|-----]/[----+
            | |SOURCE A:       T4:22.ACC|      17    |
            | |                        0|            |
            | |SOURCE B:               5|            |
            | |                        5|            |
            | +-------------------------+            |
            | T4:22.ACC - [110]                      |
            | PIRANI                                 |
            | GUAGE 2                                |
            | NO FAULT                               |
            | PGNF2                                  |
            |   I:004                                |
            +----]/[---------------------------------+
                 15
```

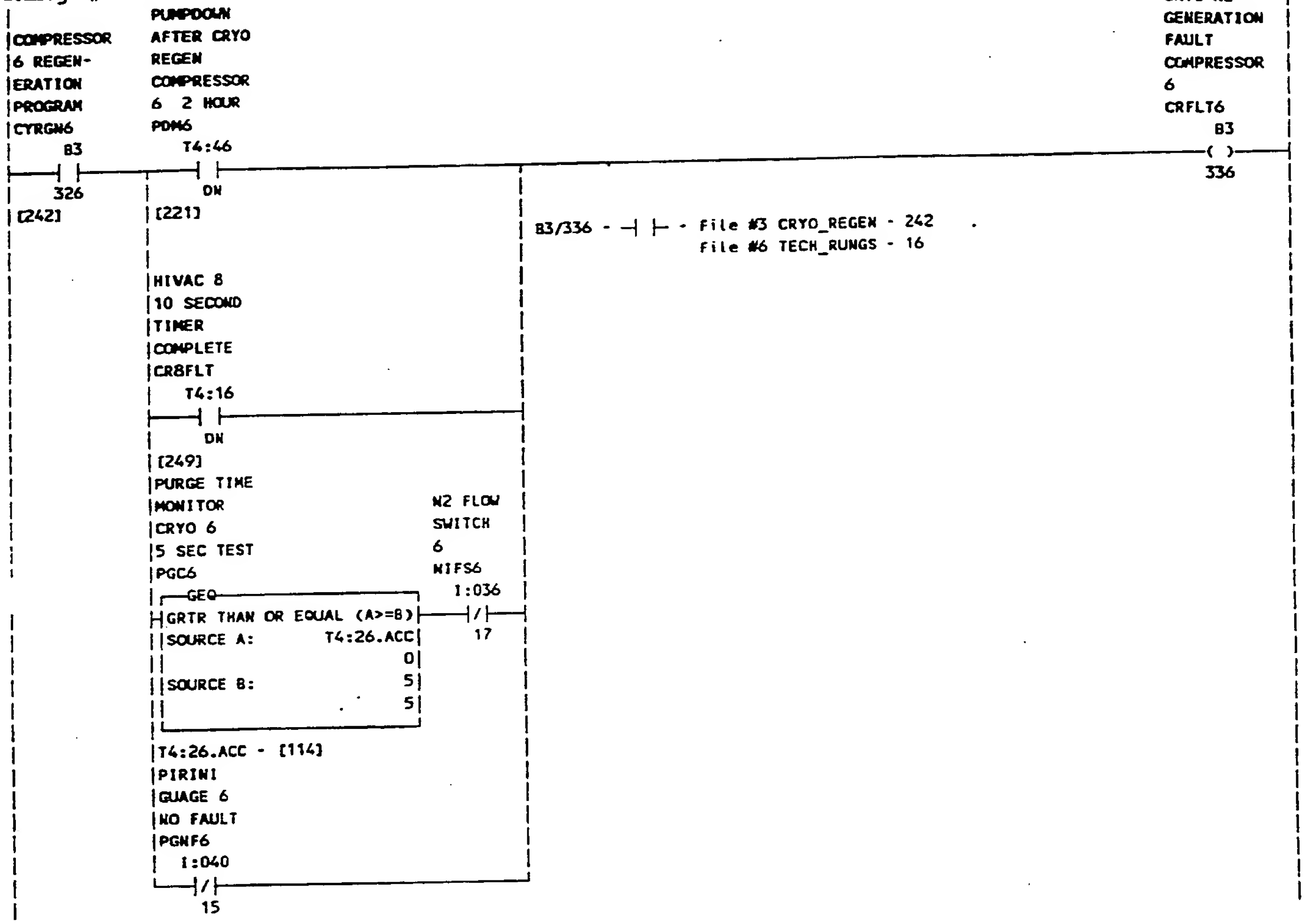
```
Rung #253
|             PUMPDOWN                                                                  CRYO RE-    |
|COMPRESSOR   AFTER CRYO                                                                GENERATION  |
|3 REGEN-     REGEN                                                                     FAULT       |
|ERATION      COMPRESSOR                                                                COMPRESSOR  |
|PROGRAM      3  2 HOUR                                                                 3           |
|CYRGM3       PDM3                                                                      CRFLT3      |
|    B3         T4:43                                                                      B3       |
|----] [-------+---] [-------------+-----------------------------------------------------( )------|
|   323        |     ON            |                                                       333      |
|[239]         |[218]              |                                                                |
|              |                   | B3/333 - -] [- - File #3 CRYO_REGEN - 239                      |
|              |                   |                  File #6 TECH_RUNGS - 16                       |
|              |HIVAC 3            |                                                                |
|              |10 SEC             |                                                                |
|              |TIMER              |                                                                |
|              |COMPLETE           |                                                                |
|              |CR3FLT             |                                                                |
|              |  T4:13            |                                                                |
|              |---] [-------------+                                                                |
|              |     ON            |                                                                |
|              |[246]              |                                                                |
|              |PURGE TIME         |                                                                |
|              |MONITOR            |                                                                |
|              |CRYO 3                        N2 FLOW SWITH |                                       |
|              |5 SEC TEST                    3             |                                       |
|              |PGC3                          NIFS3         |                                       |
|              | +-GEQ-------------------+      I:022       |                                       |
|              |-+GRTR THAN OR EQUAL (A>=B)+------]/[--------+                                       |
|              | |SOURCE A:      T4:23.ACC|      00          |                                       |
|              | |                       0|                  |                                       |
|              | |SOURCE B:              5|                  |                                       |
|              | |                       5|                  |                                       |
|              | +------------------------+                  |                                       |
|              |T4:23.ACC - [111]                            |                                       |
|              |PIRANI                                       |                                       |
|              |GUAGE 2                                      |                                       |
|              |NO FAULT                                     |                                       |
|              |PGNF2                                        |                                       |
|              |  I:004                                      |                                       |
|              +---]/[---------------------------------------+                                       |
|                   15                                                                               |
```

```
Rung #254
|                                                                              CRYO RE-     |
|            PUMPDOWN                                                          GENERATION   |
|COMPRESSOR  AFTER CRYO                                                        FAULT        |
|4 REGEN-    REGEN                                                             COMPRESSOR   |
|ERATION     COMPRESSOR                                                        4            |
|PROGRAM     4  2 HOUR                                                         CRFLT4       |
|CYRGN4      PDM4                                                                 B3        |
|    B3        T4:44                                                                        |
|----| |----+----| |--------------------+------------------------------------------( )------|
|   324     |    DN                     |                                         334       |
|[240]      |[219]                      |                                                   |
|           |                           | B3/334 - -| |- - File #3 CRYO_REGEN -. 240         |
|           |                           |                  File #6 TECH_RUNGS - 16           |
|           |HIVAC 5                    |                                                   |
|           |10 SEC                     |                                                   |
|           |TIMER                      |                                                   |
|           |COMPLETE                   |                                                   |
|           |CR5FLT                     |                                                   |
|           |  T4:14                    |                                                   |
|           +----| |--------------------+                                                   |
|           |    DN                     |                                                   |
|           |[247]                      |                                                   |
|           |PURGE TIME                 |                                                   |
|           |MONITOR                    |                                                   |
|           |CRYO 4             N2 FLOW SWITCH                                              |
|           |5 SEC TEST         4       |                                                   |
|           |PGC4               NIFS4   |                                                   |
|           | +-GEQ-------------------+   I:022  |                                          |
|           +-|GRTR THAN OR EQUAL (A>=B)|----|/|----+                                        |
|           | |SOURCE A:     T4:24.ACC|     17     |                                          |
|           | |                      0|           |                                          |
|           | |SOURCE B:             5|           |                                          |
|           | |                      5|           |                                          |
|           | +-----------------------+           |                                          |
|           |T4:24.ACC - [112]                    |                                          |
|           |PIRINI                               |                                          |
|           |GUAGE 4                              |                                          |
|           |NO FAULT                             |                                          |
|           |PGNF4                                |                                          |
|           |  I:024                              |                                          |
|           +----|/|------------------------------+                                          |
|                 15
```

Rung #255

```
|                 PUMPDOWN                                                                 CRYO RE-       |
|COMPRESSOR       AFTER CRYO                                                               GENERATION     |
|5 REGEN-         REGEN                                                                    FAULT          |
|ERATION          COMPRESSOR                                                               COMPRESSOR     |
|PROGRAM          5  2 HOUR                                                                5              |
|CYRGN5           PDN5                                                                     CRFLT5         |
|     B3              T4:45                                                                  B3           |
|----] [----------+---] [-------+-------------------------------------------------------------( )--------|
|     325         |   DN        |                                                            335          |
|[241]            |[220]        |                                                                         |
|                 |             | B3/335 - ] [ - File #3 CRYO_REGEN - 241                                 |
|                 |             |                File #6 TECH_RUNGS - 16                                  |
|                 |HIVAC 4,6,7  |                                                                         |
|                 |10 SEC       |                                                                         |
|                 |TIMER        |                                                                         |
|                 |COMPLETE     |                                                                         |
|                 |CR467FLT     |                                                                         |
|                 |   T4:15     |                                                                         |
|                 |---] [-------+                                                                         |
|                 |   DN        |                                                                         |
|                 |[248]        |                                                                         |
|                 |PURGE TIME   |                                                                         |
|                 |MONITOR      |                                                                         |
|                 |CRYO 5                     SWITCH |                                                      |
|                 |5 SEC TEST                 5      |                                                      |
|                 |PGC5                       NIFS5  |                                                      |
|                 |+-GEQ--------------------+  I:036 |                                                      |
|                 +|GRTR THAN OR EQUAL (A>=B)|---]/[--+                                                     |
|                 ||SOURCE A:      T4:25.ACC|  00    |                                                      |
|                 ||                        0|       |                                                      |
|                 ||SOURCE B:               5|       |                                                      |
|                 ||                        5|       |                                                      |
|                 |+-------------------------+       |                                                     |
|                 |T4:25.ACC - [113]                 |                                                     |
|                 |PIRINI                            |                                                     |
|                 |GUAGE 3                           |                                                     |
|                 |NO FAULT                          |                                                     |
|                 |PGNF3                             |                                                     |
|                 |  I:024                           |                                                     |
|                 |---]/[----------------------------+                                                     |
|                 |   14                             |                                                     |
|                 |PIRINI                            |                                                     |
|                 |GUAGE 4                           |                                                     |
|                 |NO FAULT                          |                                                     |
|                 |PGNF4                             |                                                     |
|                 |  I:024                           |                                                     |
|                 |---]/[----------------------------+                                                     |
|                 |   15                             |                                                     |
|                 |PIRINI                            |                                                     |
|                 |GUAGE 5                           |                                                     |
|                 |NO FAULT                          |                                                     |
|                 |PGNF5                             |                                                     |
|                 |  I:040                           |                                                     |
|                 +---]/[----------------------------+                                                     |
|                     14                                                                                   |
```

Rung #256



COMPRESSOR 6 REGEN- ERATION PROGRAM CYRGN6
B3
326
[242]
PUMPDOWN AFTER CRYO REGEN COMPRESSOR 6 2 HOUR PDM6
T4:46
DN
[221]
HIVAC 8 10 SECOND TIMER COMPLETE CR8FLT
T4:16
DN
[249]
PURGE TIME MONITOR CRYO 6 5 SEC TEST PGC6
GEQ
GRTR THAN OR EQUAL (A>=B)
SOURCE A: T4:26.ACC
0
SOURCE B: 5
5
T4:26.ACC - [114]
PIRINI GUAGE 6 NO FAULT PGNF6
I:040
15
N2 FLOW SWITCH 6 NIFS6
I:036
17
CRYO RE- GENERATION FAULT COMPRESSOR 6 CRFLT6
B3
336
B3/336 - ┤ ├ - File #3 CRYO_REGEN - 242
File #6 TECH_RUNGS - 16

Rung #257

```
|                PUMPDOWN                                                          CRYO RE-     |
|COMPRESSOR      AFTER CRYO                                                        GENERATION   |
|7 REGEN-        REGEN                                                             FAULT        |
|ERATION         COMPRESSOR                                                        COMPRESSOR   |
|PROGRAM         7  2 HOUR                                                         7            |
|CYRGN7          PDM7                                                              CRFLT7       |
|    B3            T4:47                                                             B3         |
|----] [---------+----] [------------+-----------------------------------------------( )--------|
|   327          |     DN            |                                              337         |
|[243]           |[222]              |                                                          |
|                |                   | B3/337 - ] [ - File #3 CRYO_REGEN - 243                  |
|                |                   |                File #6 TECH_RUNGS - 16                   |
|                |HIVAC 9,10,11      |                                                          |
|                |10 SEC             |                                                          |
|                |TIMER              |                                                          |
|                |COMPLETE           |                                                          |
|                |CR91012FLT         |                                                          |
|                |      T4:17        |                                                          |
|                +-------] [---------+                                                          |
|                |        DN         |                                                          |
|                |[250]              |                                                          |
|                |PURGE TIME         |                                                          |
|                |MONITOR                      N2 FLOW |                                          |
|                |CRYO 7                       SWITCH  |                                          |
|                |5 SEC TEST                   7       |                                          |
|                |PGC7                         NIFS7   |                                          |
|                | +--GEQ-----------------------+ I:052 |                                          |
|                +-|GRTR THAN OR EQUAL (A>=B)   |--]/[--+                                          |
|                | |SOURCE A:        T4:27.ACC|   00   |                                          |
|                | |                          0|        |                                          |
|                | |SOURCE B:                 5|        |                                          |
|                | |                          5|        |                                          |
|                | +--------------------------+        |                                          |
|                |T4:27.ACC - [115]                    |                                          |
|                |PIRINI                               |                                          |
|                |GUAGE 6                              |                                          |
|                |NO FAULT                             |                                          |
|                |PGNF6                                |                                          |
|                |  I:040                              |                                          |
|                +---]/[-------------------------------+                                          |
|                |   15                                |                                          |
|                |PIRINI                               |                                          |
|                |GUAGE 8                              |                                          |
|                |NO FAULT                             |                                          |
|                |PGNF8                                |                                          |
|                |  I:054                              |                                          |
|                +---]/[-------------------------------+                                          |
|                     15                                                                         |
```

Rung #258

```
|                PUMPDOWN                                                                  CRYO RE-     |
|COMPRESSOR      AFTER CRYO                                                                GENERATION   |
|8 REGEN-        REGEN                                                                     FAULT        |
|ERATION         COMPRESSOR                                                                COMPRESSOR   |
|PROGRAM         8  2 HOUR                                                                 8            |
|CYRGN8          PDM8                                                                      CRFLT8       |
|     B3            T4:48                                                                     B3        |
|----] [---------+---] [--------------+--------------------------------------------------------( )------|
|     328        |    DN              |                                                       338       |
|[244]           |[223]               |                                                                 |
|                |                    | B3/338 - ] [ - File #3 CRYO_REGEN - 244                         |
|                |                    |                File #6 TECH_RUNGS - 16                          |
|                |HIVAC 11            |                                                                 |
|                |10 SEC              |                                                                 |
|                |TIMER               |                                                                 |
|                |COMPLETE            |                                                                 |
|                |CR11FLT             |                                                                 |
|                |   T4:18            |                                                                 |
|                |---] [--------------+                                                                 |
|                |    DN              |                                                                 |
|                |[251]               |                                                                 |
|                |PURGE TIME          |                                                                 |
|                |MONITOR        N2 FLOW                                                                |
|                |CRYO 8         SWITCH                                                                 |
|                |5 SEC TEST     8    |                                                                 |
|                |PGC8           NIFS8                                                                  |
|                | +-GEQ---------+ I:052                                                                |
|                +-|GRTR THAN OR EQUAL (A>=B)|---]/[---|                                                  |
|                | |SOURCE A:    T4:28.ACC|   13     |                                                  |
|                | |                     0|          |                                                  |
|                | |SOURCE B:            5|          |                                                  |
|                | |                     5|          |                                                  |
|                | +----------------------+          |                                                  |
|                |T4:28.ACC - [116]                  |                                                  |
|                |PIRINI                             |                                                  |
|                |GUAGE 8                            |                                                  |
|                |NO FAULT                           |                                                  |
|                |PGNF8                              |                                                  |
|                |  I:054                            |                                                  |
|                +---]/[-----------------------------+                                                  |
|                    15                                                                                  |
```

573

Rung #259

```
| COMPRESSOR                                                              |
| 1 REGEN-                                                        REGEN-  |
| ERATION                                                         ERATION |
| PROGRAM                                                         'OR'    |
| CYRGN1                                                          RGN_OR  |
|      B3                                                           B3    |
|-+---] [---+---------------------------------------------------------( )-|
| |   321   |                                                        316  |
| |[25]     |                                                             |
| |         | B3/316 - ] [ - File #3 CRYO_REGEN - 260                     |
| |COMPRESSOR                                                             |
| |2 REGEN- |                                                             |
| |ERATION  |                                                             |
| |PROGRAM  |                                                             |
| |CYRGN2   |                                                             |
| |    B3   |                                                             |
| |---] [---|                                                             |
| |   322   |                                                             |
| |[238]    |                                                             |
| |COMPRESSOR                                                             |
| |3 REGEN- |                                                             |
| |ERATION  |                                                             |
| |PROGRAM  |                                                             |
| |CYRGN3   |                                                             |
| |    B3   |                                                             |
| |---] [---|                                                             |
|     323   |                                                             |
| |[239]    |                                                             |
| |COMPRESSOR                                                             |
| |4 REGEN- |                                                             |
| |ERATION  |                                                             |
| |PROGRAM  |                                                             |
| |CYRGN4   |                                                             |
| |    B3   |                                                             |
| |---] [---|                                                             |
| |   324   |                                                             |
| |[240]    |                                                             |
| |COMPRESSOR                                                             |
| |5 REGEN- |                                                             |
| |ERATION  |                                                             |
| |PROGRAM  |                                                             |
| |CYRGN5   |                                                             |
| |    B3   |                                                             |
| |---] [---|                                                             |
| |   325   |                                                             |
| |[241]    |                                                             |
| |COMPRESSOR                                                             |
| |6 REGEN- |                                                             |
|   ATION   |                                                             |
| |PROGRAM  |                                                             |
| |CYRGN6   |                                                             |
| |    B3   |                                                             |
| |---] [---|                                                             |
| |   326   |                                                             |
| |[242]    |                                                             |
| |COMPRESSOR                                                             |
| |7 REGEN- |                                                             |
| |ERATION  |                                                             |
| |PROGRAM  |                                                             |
| |CYRGN7   |                                                             |
| |    B3   |                                                             |
| |---] [---|                                                             |
> >         >                                                             >
```

```
327
[243]
COMPRESSOR
8 REGEN-
ERATION
PROGRAM
CYRGN8
B3
328
[244]
```

Rung #260

```
REGEN-      ENABLE     ENABLE     ENABLE     ENABLE     ENABLE     ENABLE     ENABLE     ENABLE
ERATION     CRYO       CRYO       CRYO       CRYO       CRYO       CRYO       CRYO       CRYO
'OR'        COMPRESSOR COMPRESSOR COMPRESSOR COMPRESSOR COMPRESSOR COMPRESSOR COMPRESSOR COMPRESSOR   COOL DOWN MODE
RGN_OR      1          2          3          4          5          6          7          8            MP2 OFF DELAY
            CY1        CY2        CY3        CY4        CY5        CY6        CY7        CY8          CD_MP2OFF
 B3         O:010      O:010      O:030      O:030      O:044      O:044      O:060      O:060       TON
                                                                                                     TIMER ON DELAY   (EN)
 316        04         05         04         05         04         05         04         05          TIMER:      T4:79
[259]       [6]        [81]       [82]       [83]       [84]       [85]       [86]       [87]        BASE (SEC):   1.0 (DN)
                                                                                                     PRESET:      3600
                                                                                                     ACCUM:          0

T4:79.DN - -| |- - File #3 CRYO_REGEN - 261
```

Rung #261

```
            DWELL 2     DWELL 4    DWELL 5                                  CRYO REGEN
            CHAMBER     CHAMBER    CHAMBER                                  MECH PUMP AND
            ROUGH       ROUGH      ROUGH                                    BLOWER 2
            VALVE RV2   VALVE      VALVE                                    DISABLE
            CLOSED      CLOSED     CLOSED                                   CRMPBL2D
CD_MP2OFF   RVS3        RVS5       RVS7                                     TON
 T4:79      I:022       I:036      I:052                                    TIMER ON DELAY   (EN)
 DN         15          15         14                                       TIMER:     T4:170
[260]                                                                       BASE (SEC):  0.01 (DN)
                                                                            PRESET:       100
                                                                            ACCUM:          0

T4:170.TT - -| |- - File #2 MAIN_PRGRM - 91
```

575

Rung #262

```
| PURGE TIME
| MONITOR
| CRYO 1
| 60 MIN
| DONE                                                                           PURGE COMPLETE
| PGC1                                                                           PRGDONE
|     T4:21                                                                      +--TON---------------+
+--+----] [----+---------------------------------------------------------------+TIMER ON DELAY      +-(EN)-
|  |     DN    |                                                               |TIMER:      T4:130|
|  |[9]        |                                                               |BASE (SEC):    1.0+-(DN)
|  |           | T4:130.TT - -] [- - File #2 MAIN_PRGRM - 73                   |PRESET:         10|
|  |PURGE TIME |                                                               |ACCUM:           0|
|  |MONITOR    |                                                               +-------------------+
|  |CRYO 2     |
|  |120 MIN.   |
|  |DONE       |
|  |PGC2       |
|  |   T4:22   |
|  +----] [----+
|  |     DN    |
|  |[110]      |
|  |PURGE TIME |
|  |MONITOR    |
|  |CRYO 3     |
|  |120 MIN.   |
|  |DONE       |
|  |PGC3       |
|  |   T4:23   |
|  +----] [----+
|  |     DN    |
|  |[111]      |
|  |PURGE TIME |
|  |MONITOR    |
|  |CRYO 4     |
|  |120 MIN    |
|  |DONE       |
|  |PGC4       |
|  |   T4:24   |
|  +----] [----+
|  |     DN    |
|  |[112]      |
|  |PURGE TIME |
|  |MONITOR    |
|  |CRYO 5     |
|  |120 MIN    |
|  |DONE       |
|  |PGC5       |
|  |   T4:25   |
|  +----] [----+
|  |     DN    |
|  |[113]      |
|  |PURGE TIME |
|  |MONITOR    |
|  |CRYO 6     |
|  |120 MIN    |
|  |DONE       |
|  |PGC6       |
|  |   T4:26   |
|  +----] [----+
|  |     DN    |
|  |[114]      |
|  |PURGE TIME |
>  >           >                                                                                          >
```

576

```
< <                <
| |MONITOR         |
| |CRYO 7          |
| |120 MIN         |
| |DONE            |
| |PGC7            |
| |    T4:27       |
| |------| |-------|
| |       DN       |
| |[115]           |
| |PURGE TIME      |
| |MONITOR         |
| |CRYO 8          |
| |120 MIN         |
| |DONE            |
| |PGC8            |
| |    T4:28       |
| |------| |-------
|         DN
|  [116]
```

577

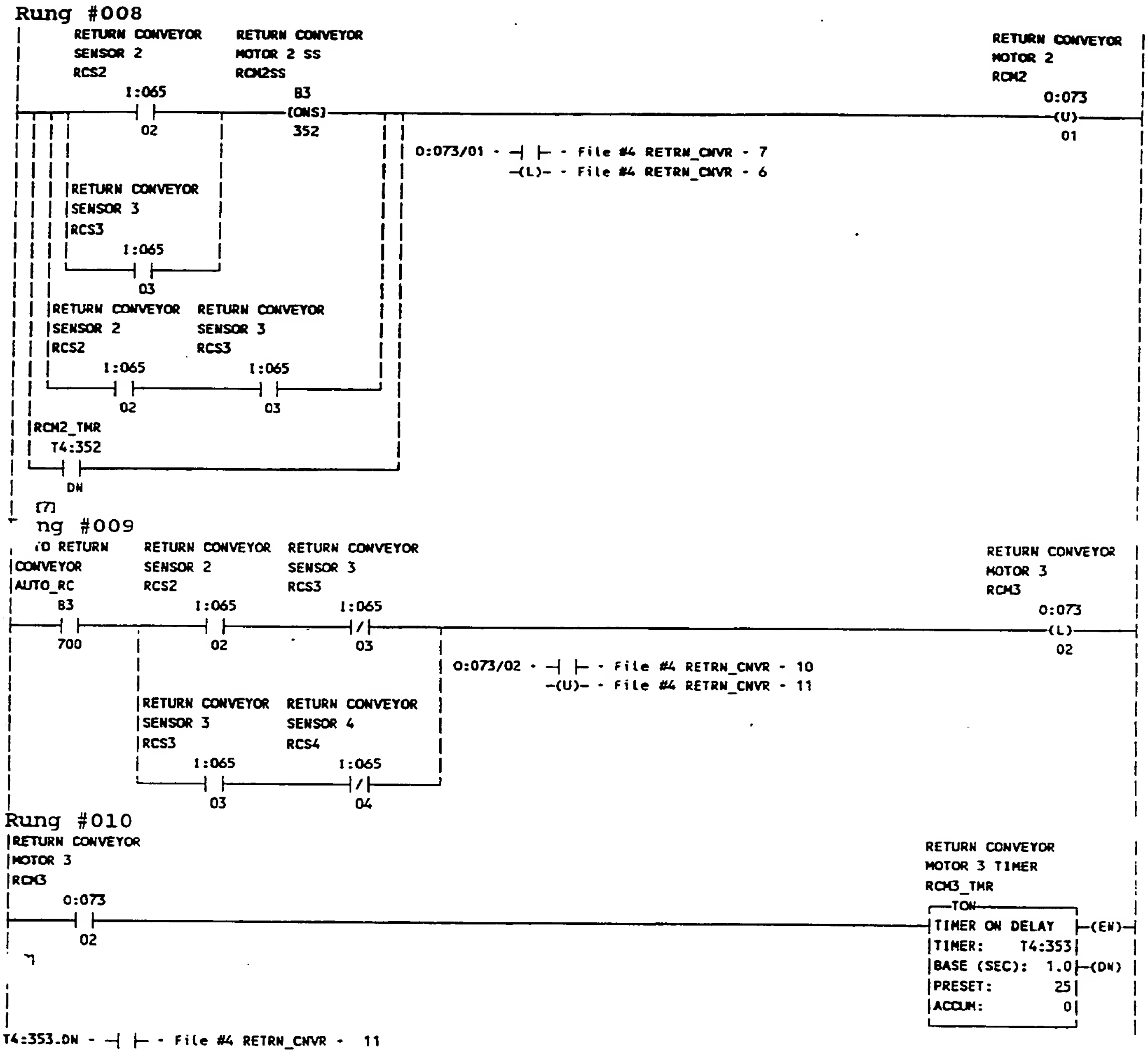
```
Rung #263
|                                                                      SIEVE TRAP
|                                                                      MECH PUMP  |
|                                                                      ENABLE     |
|  S_TRAP_1                                                            SVMPEN     |
|   T4:341                                                                B3      |
|-+--] [--+-------------------------------------------------------------( )-----|
| |   TT  |                                                              125      |
| |[1]    |                                                                       |
| |       | B3/125 - -] [- - File #2 MAIN_PRGRM - 73                              |
| |S_TRAP_2|                                                                      |
| | T4:342 |                                                                      |
| |---] [--|                                                                      |
| |   TT   |                                                                      |
| |[35]    |                                                                      |
| |S_TRAP_3|                                                                      |
| | T4:343 |                                                                      |
| |---] [--|                                                                      |
| |   TT   |                                                                      |
| |[39]    |                                                                      |
| |S_TRAP_4|                                                                      |
| | T4:344 |                                                                      |
| |---] [--|                                                                      |
| |   TT   |                                                                      |
| |[43]    |                                                                      |
| |S_TRAP_5|                                                                      |
| | T4:345 |                                                                      |
|  ---] [--|                                                                      |
| |   TT   |                                                                      |
| |[47]    |                                                                      |
| |S_TRAP_6|                                                                      |
| | T4:346 |                                                                      |
| |---] [--|                                                                      |
| |   TT   |                                                                      |
| |[54]    |                                                                      |
| |S_TRAP_7|                                                                      |
| | T4:347 |                                                                      |
| |---] [--|                                                                      |
| |   TT   |                                                                      |
| |[58]    |                                                                      |
| |S_TRAP_8|                                                                      |
| | T4:348 |                                                                      |
| +---] [--+                                                                      |
|     TT                                                                          |
|  [64]                                                                           |
Rung #264
|                                                       SIEVE MECHANICA      SIEVE TRAP  |
|                                                       PUMP DISABLE         MECH PUMP   |
|                                                       PULSE                DISABLE     |
  TRAP_1 S_TRAP_2 S_TRAP_3 S_TRAP_4 S_TRAP_5 S_TRAP_6 S_TRAP_7 S_TRAP_8 SMPDP  SVMPDIS   |
| T4:341  T4:342   T4:343   T4:344   T4:345   T4:346   T4:347   T4:348   B3        B3    |
|--]/[-----]/[------]/[-----]/[------]/[------]/[------]/[------]/[------[ONS]-----( )---|
|   TT      TT       TT       TT       TT       TT       TT       TT     175       102   |
|[1]      [35]     [39]     [43]     [47]     [54]     [58]     [64]                      |
B3/102 - -] [- - File #2 MAIN_PRGRM -  91
       -( )- - File #3 CRYO_REGEN -  264
Rung #265
|                                                              RETURN FROM        |
|                                                              RETURN CONVEYOR    |
|                                                              TO MAIN PROGRAM    |
|                                                              RTN_MAIN           |
|                                                              +-RET-----------+  |
|-------------------------------------------------------------|RETURN ()      |--|
>                                                             >>>>>>>>>>>>>>>>> >
```

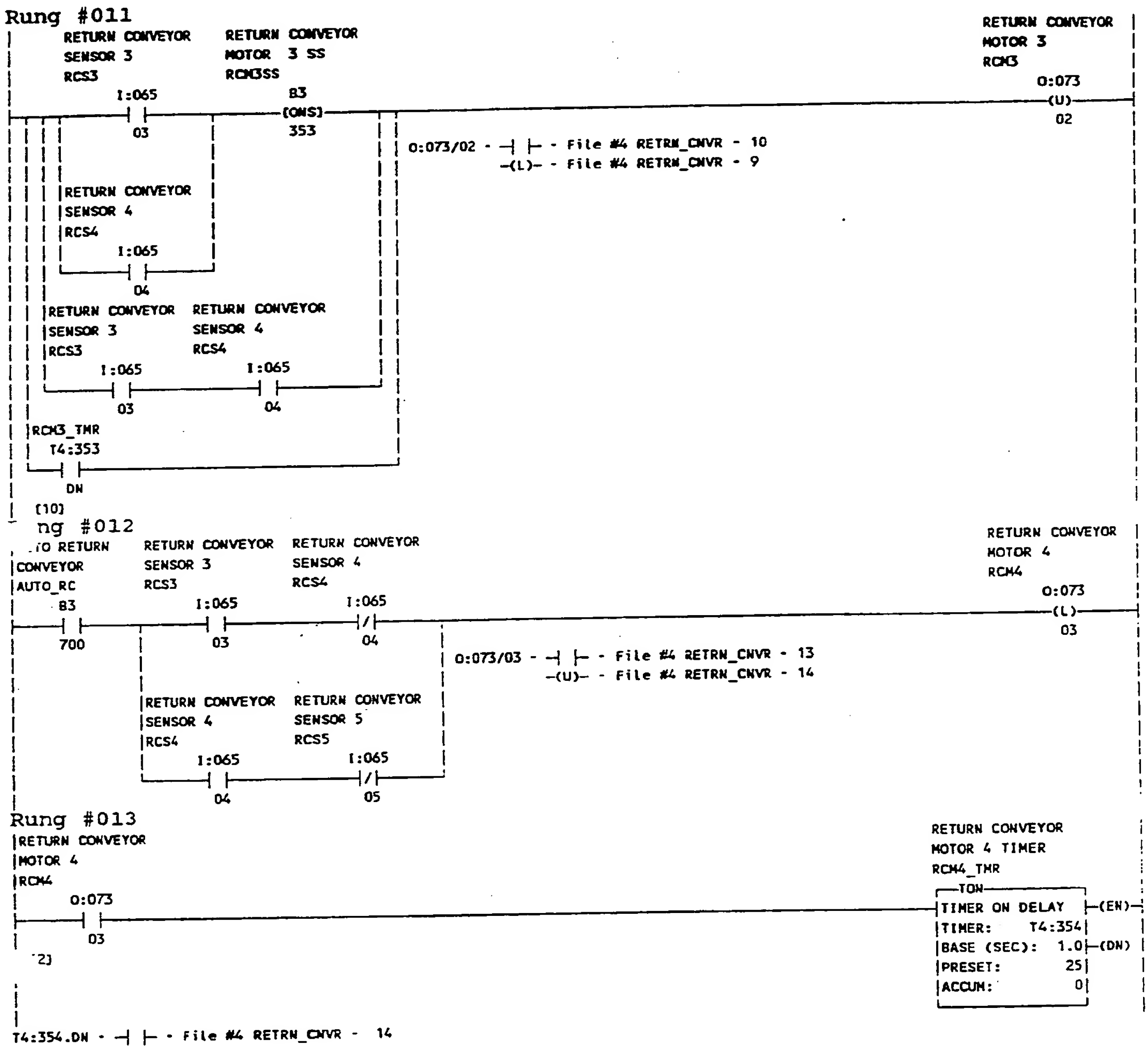
Rung #266 ——[END]—

```
Rung #000
|AUTO RETURN  RETURN CONVEYOR  PALETTE READY  RETURN CONVEYOR  RETURN CONVEYOR               RETURN CONVEYOR  |
|CONVEYOR     MANUAL ON        AT ROBOT       GATE             SENSOR 1                      MOTOR 1          |
|AUTO_RC      RCMAN_ON         PAL_RDY        RC_GATE          RCS1                          RCM1             |
|   B3            I:066           I:065          B3              I:065                           O:073        |
|----] [----------]/[--------+------] [----------]/[--------------]/[----+--------------------------(L)--------|
|   700            07        |      00           701              01     |                          00        |
|                            |                  [3]                     |                                    |
|                            |RETURN CONVEYOR  RETURN CONVEYOR          |                                    |
|                            |SENSOR 1         SENSOR 2                 |                                    |
|                            |RCS1             RCS2                     |                                    |
|                            |    I:065          I:065                  |                                    |
|                            +-----] [------------]/[-------------------+                                    |
|                                  01             02                                                         |
O:073/00 - ] [ - - File #4 RETRN_CNVR -  1,3
          -(L)- - File #4 RETRN_CNVR -  0
          -(U)- - File #4 RETRN_CNVR -  2
Rung #001
|RETURN CONVEYOR                                                            RETURN CONVEYOR       |
|MOTOR 1                                                                    MOTOR 1 TIMER         |
|RCM1                                                                       RCM1_TMR              |
|   O:073                                                                   +--TON-----------+    |
|----] [--------------------------------------------------------------------+TIMER ON DELAY  +-(EN)-|
|     00                                                                    |TIMER:   T4:351 |    |
|[0]                                                                        |BASE (SEC):  1.0+-(DN)|
|                                                                           |PRESET:       25|    |
|                                                                           |ACCUM:         0|    |
|                                                                           +----------------+    |
T4:351.DN - ] [ - - File #4 RETRN_CNVR -  2
Rung #002
|      RETURN CONVEYOR     RETURN CONVEYOR                                  RETURN CONVEYOR  |
|      SENSOR 1            MOTOR 1 SS                                       MOTOR 1          |
|      RCS1                RCM1SS                                           RCM1             |
|          I:065              B3                                               O:073        |
|-+-+-+-+---] [-----+-------[ONS]----+-+-------------------------------------------(U)--------|
| | | | |     01    |        350     | |                                            00        |
| | | | |           |                | | O:073/00 - ] [ - - File #4 RETRN_CNVR - 1, 3         |
| | | | |           |                | |          -(L)- - File #4 RETRN_CNVR - 0             |
| | | | |RETURN CONVEYOR             | |                                                      |
| | | | |SENSOR 2   |                | |                                                      |
| | | | |RCS2       |                | |                                                      |
| | | | |   I:065   |                | |                                                      |
| | | | +---] [-----+                | |                                                      |
| | | |      02                      | |                                                      |
| | | |RETURN CONVEYOR  RETURN CONVEYOR| |                                                    |
| | | |SENSOR 1         SENSOR 2     | |                                                      |
| | | |RCS1             RCS2         | |                                                      |
| | | |   I:065            I:065     | |                                                      |
| | | +---] [--------------] [-------+ |                                                      |
| | |      01               02         |                                                      |
| |RCM1_TMR                            |                                                      |
| |  T4:351                            |                                                      |
| +---] [----------------------------- +                                                      |
|      DN                                                                                     |
|  [1]                                                                                        |
Rung #003
|RETURN CONVEYOR                                                            RETURN CONVEYOR  |
|MOTOR 1                                                                    GATE             |
|RCM1                                                                       RC_GATE          |
|   O:073                                                                      B3            |
|----] [-------------------------------------------------------------------------(L)---------|
|     00                                                                       701           |
|[2]                                                                                         |
```

```
B3/701 - -| |- - File #4 RETRN_CNVR -  4
         -|/|- - File #4 RETRN_CNVR -  0
         -(L)- - File #4 RETRN_CNVR -  3
         -(U)- - File #4 RETRN_CNVR -  5
Rung #004
|RETURN CONVEYOR                                                    RETURN CONVEYOR      |
|GATE                                                               GATE TIMER           |
|RC_GATE                                                            RC_GATE_TMRA         |
|        B3                                                         +-TON-----------+    |
|--------| |--------------------------------------------------------+TIMER ON DELAY +-(EN)-|
|        701                                                        |TIMER:   T4:350|    |
|[3]                                                                |BASE (SEC):  1.0+-(DN) |
|                                                                   |PRESET:      25|    |
|                                                                   |ACCUM:        0|    |
|                                                                   +---------------+    |
T4:350.DN - -| |- - File #4 RETRN_CNVR -  5
Rung #005
|                                                                       RETURN CONVEYOR |
|                                                                       GATE            |
|RC_GATE_TMRA                                                           RC_GATE         |
|   T4:350                                                                  B3          |
|-----| |---------------------------------------------------------------------(U)-------|
|      DN                                                                   701         |
|[4]                                                                                    |
B3/701 - -| |- - File #4 RETRN_CNVR -  4
         -|/|- - File #4 RETRN_CNVR -  0
         -(L)- - File #4 RETRN_CNVR -  3
         -(U)- - File #4 RETRN_CNVR -  5
Rung #006
|AUTO RETURN    RETURN CONVEYOR  RETURN CONVEYOR                        RETURN CONVEYOR |
|CONVEYOR       SENSOR 1         SENSOR 2                               MOTOR 2         |
|AUTO_RC        RCS1             RCS2                                   RCM2            |
|    B3              I:065            I:065                                 O:073       |
|----| |-----+-------| |--------------|/|-----+--------------------------------(L)-------|
|    700     |        01               02     |                              01         |
|            |                                | O:073/01 - -| |- - File #4 RETRN_CNVR - 7
|            |                                |             -(U)- - File #4 RETRN_CNVR - 8
|            |RETURN CONVEYOR  RETURN CONVEYOR|                                         |
|            |SENSOR 2         SENSOR 3       |                                         |
|            |RCS2             RCS3           |                                         |
|            |       I:065            I:065   |                                         |
|            +-------| |--------------|/|-----+                                         |
|                    02               03                                                |
Rung #007
|RETURN CONVEYOR                                                    RETURN CONVEYOR      |
|MOTOR 2                                                            MOTOR 2 TIMER        |
|RCM2                                                               RCM2_TMR             |
|     O:073                                                         +-TON-----------+    |
|--------| |--------------------------------------------------------+TIMER ON DELAY +-(EN)-|
|        01                                                         |TIMER:   T4:352|    |
|[6]                                                                |BASE (SEC):  1.0+-(DN) |
|                                                                   |PRESET:      25|    |
|                                                                   |ACCUM:        0|    |
|                                                                   +---------------+    |
T4:352.DN - -| |- - File #4 RETRN_CNVR -  8
```

581


Rung #008
RETURN CONVEYOR SENSOR 2 RCS2
I:065
02
RETURN CONVEYOR MOTOR 2 SS RCM2SS
B3
[ONS]
352
RETURN CONVEYOR MOTOR 2 RCM2
O:073
(U)
01
O:073/01 - ┤ ├ - File #4 RETRN_CNVR - 7
-(L)- - File #4 RETRN_CNVR - 6
RETURN CONVEYOR SENSOR 3 RCS3
I:065
03
RETURN CONVEYOR SENSOR 2 RCS2
I:065
02
RETURN CONVEYOR SENSOR 3 RCS3
I:065
03
RCM2_TMR
T4:352
DN
[7]
ng #009
TO RETURN CONVEYOR AUTO_RC
B3
700
RETURN CONVEYOR SENSOR 2 RCS2
I:065
02
RETURN CONVEYOR SENSOR 3 RCS3
I:065
03
RETURN CONVEYOR MOTOR 3 RCM3
O:073
(L)
02
O:073/02 - ┤ ├ - File #4 RETRN_CNVR - 10
-(U)- - File #4 RETRN_CNVR - 11
RETURN CONVEYOR SENSOR 3 RCS3
I:065
03
RETURN CONVEYOR SENSOR 4 RCS4
I:065
04
Rung #010
RETURN CONVEYOR MOTOR 3 RCM3
O:073
02
RETURN CONVEYOR MOTOR 3 TIMER RCM3_TMR
TON
TIMER ON DELAY
(EN)
TIMER: T4:353
BASE (SEC): 1.0
(DN)
PRESET: 25
ACCUM: 0
T4:353.DN - ┤ ├ - File #4 RETRN_CNVR - 11


Rung #011
RETURN CONVEYOR SENSOR 3 RCS3
I:065
03
RETURN CONVEYOR MOTOR 3 SS RCM3SS
B3
(ONS)
353
RETURN CONVEYOR MOTOR 3 RCM3
0:073
(U)
02
0:073/02 - ┤ ├ - File #4 RETRN_CNVR - 10
-(L)- - File #4 RETRN_CNVR - 9
RETURN CONVEYOR SENSOR 4 RCS4
I:065
04
RETURN CONVEYOR SENSOR 3 RCS3
I:065
03
RETURN CONVEYOR SENSOR 4 RCS4
I:065
04
RCM3_TMR
T4:353
DN
[10]
ng #012
TO RETURN CONVEYOR AUTO_RC
B3
700
RETURN CONVEYOR SENSOR 3 RCS3
I:065
03
RETURN CONVEYOR SENSOR 4 RCS4
I:065
04
RETURN CONVEYOR MOTOR 4 RCM4
0:073
(L)
03
0:073/03 - ┤ ├ - File #4 RETRN_CNVR - 13
-(U)- - File #4 RETRN_CNVR - 14
RETURN CONVEYOR SENSOR 4 RCS4
I:065
04
RETURN CONVEYOR SENSOR 5 RCS5
I:065
05
Rung #013
RETURN CONVEYOR MOTOR 4 RCM4
0:073
03
2]
RETURN CONVEYOR MOTOR 4 TIMER RCM4_TMR
TON
TIMER ON DELAY
TIMER: T4:354
BASE (SEC): 1.0
PRESET: 25
ACCUM: 0
(EN)
(DN)
T4:354.DN - ┤ ├ - File #4 RETRN_CNVR - 14

```
Rung #014
|     RETURN CONVEYOR      RETURN CONVEYOR                                   RETURN CONVEYOR |
|     SENSOR 4             MOTOR 4 SS                                        MOTOR 4         |
|     RCS4                 RCM4SS                                            RCM4            |
|            I:065                  B3                                            O:073      |
|-+-+-+-+----] [----+----------[ONS]---+-+--------------------------------------(U)-------|
| | | |      04     |           354    | |                                          03     |
| | | |             |                  | | O:073/03 - ] [ - File #4 RETRN_CNVR - 13        |
| | | |             |                  | |       -(L)- - File #4 RETRN_CNVR - 12           |
| | | |RETURN CONVEYOR|                | |                                                 |
| | | |SENSOR 5     |                  | |                                                 |
| | | |RCS5         |                  | |                                                 |
| | | |      I:065  |                  | |                                                 |
| | | +-----] [-----+                  | |                                                 |
| | |         05                       | |                                                 |
| | |RETURN CONVEYOR  RETURN CONVEYOR  | |                                                 |
| | |SENSOR 4         SENSOR 5         | |                                                 |
| | |RCS4             RCS5             | |                                                 |
| | |     I:065           I:065        | |                                                 |
| | +-----] [-------------] [----------+ |                                                 |
| |        04              05            |                                                 |
| |RCM4_TMR                              |                                                 |
| |  T4:354                              |                                                 |
| +---] [--------------------------------+                                                 |
|      DN
| [13]
Rung #015
|  O RETURN    RETURN CONVEYOR   RETURN CONVEYOR                            RETURN CONVEYOR |
|CONVEYOR      SENSOR 4          SENSOR 5                                   MOTOR 5         |
|AUTO_RC       RCS4              RCS5                                       RCM5            |
|   B3               I:065           I:065                                     O:073        |
|---] [-----+--------] [-------------]/[----+-----------------------------------(L)-------|
|   700     |         04              05    |                                      04      |
|           |                               | O:073/04 - ] [ - File #4 RETRN_CNVR - 16     |
|           |                               |      -(U)- - File #4 RETRN_CNVR - 17         |
|           |RETURN CONVEYOR  RETURN CONVEYOR|                                             |
|           |SENSOR 5         SENSOR 6      |                                              |
|           |RCS5             RCS6          |                                              |
|           |      I:065          I:065     |                                              |
|           +------] [------------]/[-------+                                              |
|                   05             06
Rung #016
|RETURN CONVEYOR                                          RETURN CONVEYOR
|MOTOR 5                                                  MOTOR 5 TIMER
|RCM5                                                     RCM5_THR
|       O:073                                             +-TON---------------+
|-------] [-----------------------------------------------|TIMER ON DELAY     |-(EN)-
|        04                                               |TIMER:      T4:355 |
| ''5]                                                    |BASE (SEC):    1.0 |-(DN)
|                                                         |PRESET:         25 |
|                                                         |ACCUM:           0 |
|                                                         +-------------------+
T4:355.DN - ] [ - File #4 RETRN_CNVR - 17
```

584

Rung #017

```
|    RETURN CONVEYOR     RETURN CONVEYOR                                          RETURN CONVEYOR |
|    SENSOR 5            MOTOR 5 SS                                               MOTOR 5         |
|    RCS5                RCM5SS                                                   RCM5            |
|        I:065               B3                                                     O:073        |
|----+----] [------+-------[ONS]---+-+--------------------------------------------------(U)------|
| | | |    05      |        355    | |                                                   04       |
| | | |            |               | | O:073/04 - ] [ - File #4 RETRN_CNVR - 16                   |
| | | |            |               | |          -(L)- - File #4 RETRN_CNVR - 15                   |
| | | |RETURN CONVEYOR             | |                                                            |
| | | |SENSOR 6    |               | |                                                            |
| | | |RCS6        |               | |                                                            |
| | | |    I:065   |               | |                                                            |
| | | +----] [-----+               | |                                                            |
| | |       06                     | |                                                            |
| | |RETURN CONVEYOR  RETURN CONVEYOR |                                                           |
| | |SENSOR 5         SENSOR 6     | |                                                            |
| | |RCS5             RCS6         | |                                                            |
| | |   I:065            I:065     | |                                                            |
| | +----] [--------------] [------+ |                                                            |
| |       05                06       |                                                            |
| |RCM5_TMR                          |                                                            |
| | T4:355                           |                                                            |
| +---] [----------------------------+                                                            |
|      DN                                                                                         |
| [16]
```

Rung #018

```
 TO RETURN     RETURN CONVEYOR    RETURN CONVEYOR                              RETURN CONVEYOR |
|CONVEYOR      SENSOR 5           SENSOR 6                                     MOTOR 6         |
|AUTO_RC       RCS5               RCS6                                         RCM6            |
|  B3              I:065              I:065                                       O:073        |
|---] [------+------] [---------------]/[------+------------------------------------(L)--------|
|   700      |       05                 06     |                                   05          |
|            |                                 | O:073/05 - ] [ - File #4 RETRN_CNVR - 19      |
|            |                                 |          -(U)- - File #4 RETRN_CNVR - 20      |
|            |RETURN CONVEYOR    RETURN CONVEYOR                                               |
|            |SENSOR 6           SENSOR 7      |                                               |
|            |RCS6               RCS7          |                                               |
|            |     I:065              I:065    |                                               |
|            +------] [----------------]/[-----+                                               |
|                    06                 07                                                     |
```

Rung #019

```
|RETURN CONVEYOR                                         RETURN CONVEYOR              |
|MOTOR 6                                                 MOTOR 6 TIMER                |
|RCM6                                                    RCM6_TMR                     |
|    0:073                                               +-TON------------------+     |
|-----] [------------------------------------------------+TIMER ON DELAY        +-(EN)-|
|      05                                                |TIMER:        T4:356  |     |
| [18]                                                   |BASE (SEC):      1.0  +-(DN) |
|                                                        |PRESET:           25  |     |
|                                                        |ACCUM:             0  |     |
|                                                        +----------------------+     |
T4:356.DN - ] [ - File #4 RETRN_CNVR - 20
```

585

```
Rung #020
|        RETURN CONVEYOR    RETURN CONVEYOR                                                   RETURN CONVEYOR |
|        SENSOR 6           MOTOR 6 SS                                                         MOTOR 6        |
|        RCS6               RCM6SS                                                             RCM6           |
|            I:065              B3                                                                 O:073      |
|-+-+-+-+----] [------+-------[ONS]---+-+--------------------------------------------------------(U)--------|
| | | | |     06      |        356    | |                                                          05         |
| | | | |             |               | | O:073/05 - ] [ - File #4 RETRN_CNVR - 19                            |
| | | | |             |               | |            -(L)- - File #4 RETRN_CNVR - 18                            |
| | | | |RETURN CONVEYOR              | |                                                                     |
| | | | |SENSOR 7     |               | |                                                                     |
| | | | |RCS7         |               | |                                                                     |
| | | | |    I:065    |               | |                                                                     |
| | | | +----] [------+               | |                                                                     |
| | | |       07                      | |                                                                     |
| | | |RETURN CONVEYOR  RETURN CONVEYOR | |                                                                     |
| | | |SENSOR 6         SENSOR 7      | |                                                                     |
| | | |RCS6             RCS7          | |                                                                     |
| | | |    I:065           I:065      | |                                                                     |
| | | +-----] [---------------] [-----+ |                                                                     |
| | |        06               07        |                                                                     |
| | |RCM6_TMR                           |                                                                     |
| | | T4:356                            |                                                                     |
| | +---] [-----------------------------+                                                                     |
| |      DN                                                                                                   |
| [19]
Rung #021
|AUTO RETURN  RETURN CONVEYOR  RETURN CONVEYOR                                              RETURN CONVEYOR |
|CONVEYOR     SENSOR 6         SENSOR 7                                                     MOTOR 7        |
|AUTO_RC      RCS6             RCS7                                                         RCM7           |
|   B3            I:065           I:065                                                        O:073       |
|----] [-----+-----] [-------------]/[----+-----------------------------------------------------(L)---------|
|   700      |      06              07    |                                                     06          |
|            |                            | O:073/06 - ] [ - File #4 RETRN_CNVR - 22                         |
|            |                            |            -(U)- - File #4 RETRN_CNVR - 23                         |
|            |RETURN CONVEYOR  RETURN CONVEYOR                                                              |
|            |SENSOR 7         SENSOR 8   |                                                                 |
|            |RCS7             RCS8       |                                                                 |
|            |     I:065          I:065   |                                                                 |
|            +-----] [-------------]/[----+                                                                 |
|                   07              10                                                                      |
Rung #022
|RETURN CONVEYOR                                                        RETURN CONVEYOR          |
|MOTOR 7                                                                MOTOR 7 TIMER            |
|RCM7                                                                   RCM7_TMR                 |
|    O:073                                                              +-TON-----------------+  |
|-----] [---------------------------------------------------------------+TIMER ON DELAY       +-(EN)-|
|      06                                                               |TIMER:        T4:357|  |
| [21]                                                                  |BASE (SEC):     1.0+-(DN) |
|                                                                       |PRESET:           25|  |
|                                                                       |ACCUM:             0|  |
|                                                                       +--------------------+  |
T4:357.DN - ] [ - File #4 RETRN_CNVR - 23
```

Rung #023

RETURN CONVEYOR SENSOR 7 RCS7 I:065 07
RETURN CONVEYOR MOTOR 7 SS RCM7SS B3 [ONS] 357
RETURN CONVEYOR MOTOR 7 RCM7 O:073 (U) 06
O:073/06 - ┤ ├ - File #4 RETRN_CNVR - 22
-(L)- - File #4 RETRN_CNVR - 21
RETURN CONVEYOR SENSOR 8 RCS8 I:065 10
RETURN CONVEYOR SENSOR 7 RCS7 I:065 07
RETURN CONVEYOR SENSOR 8 RCS8 I:065 10
RCM7_TMR T4:357 DN
[22]

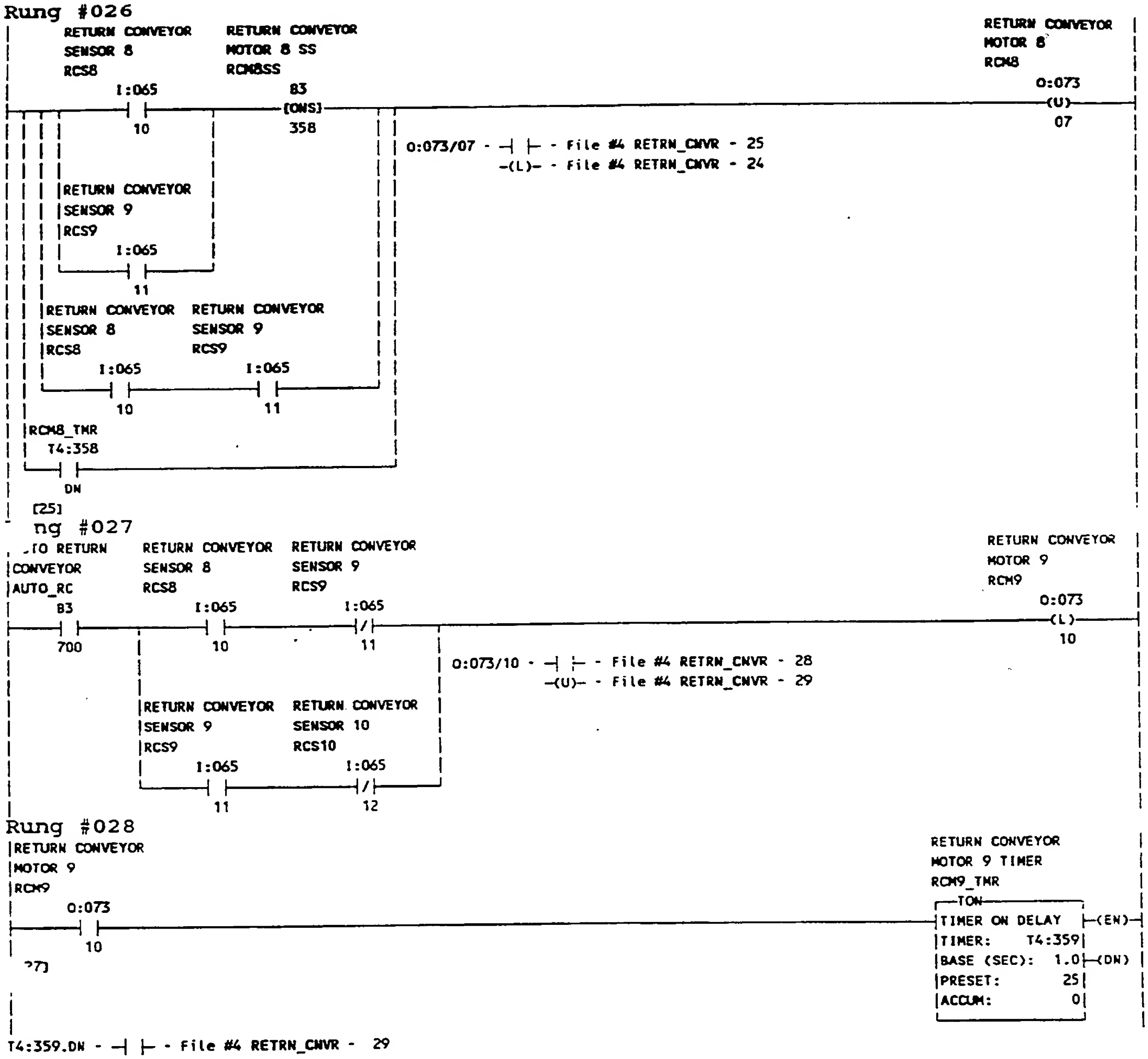
Rung #024

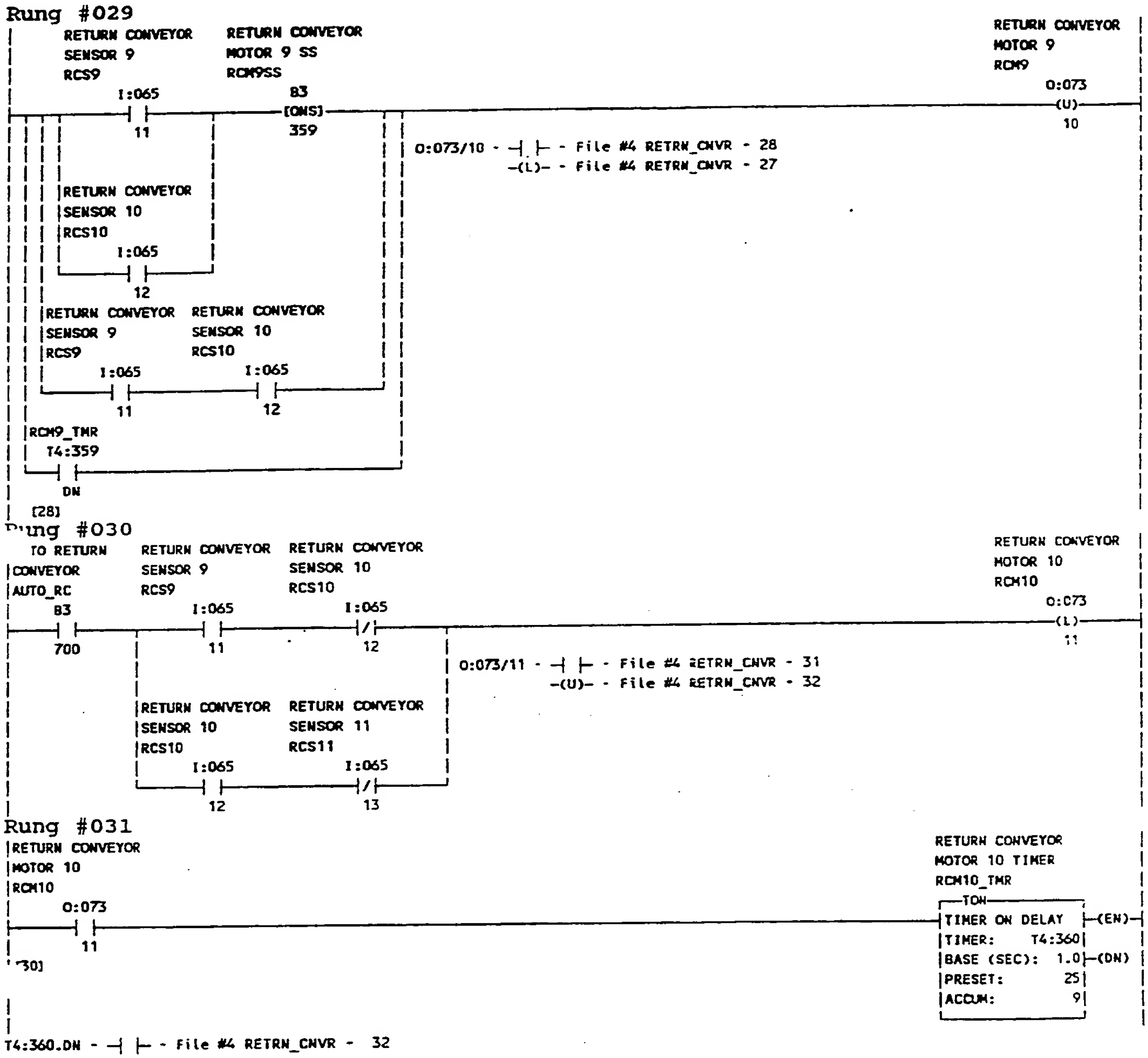
AUTO RETURN CONVEYOR AUTO_RC B3 700
RETURN CONVEYOR SENSOR 7 RCS7 I:065 07
RETURN CONVEYOR SENSOR 8 RCS8 I:065 ┤/├ 10
RETURN CONVEYOR MOTOR 8 RCM8 O:073 (L) 07
O:073/07 - ┤ ├ - File #4 RETRN_CNVR - 25
-(U)- - File #4 RETRN_CNVR - 26
RETURN CONVEYOR SENSOR 8 RCS8 I:065 10
RETURN CONVEYOR SENSOR 9 RCS9 I:065 ┤/├ 11

Rung #025

RETURN CONVEYOR MOTOR 8 RCM8 O:073 07
[24]
RETURN CONVEYOR MOTOR 8 TIMER RCM8_TMR
TON
TIMER ON DELAY (EN)
TIMER: T4:358
BASE (SEC): 1.0 (DN)
PRESET: 25
ACCUM: 0

T4:358.DN - ┤ ├ - File #4 RETRN_CNVR - 26


Rung #026
RETURN CONVEYOR SENSOR 8 RCS8
I:065
10
RETURN CONVEYOR MOTOR 8 SS RCM8SS
B3
[ONS]
358
RETURN CONVEYOR MOTOR 8 RCM8
O:073
(U)
07
O:073/07 - -| |- - File #4 RETRN_CNVR - 25
-(L)- - File #4 RETRN_CNVR - 24
RETURN CONVEYOR SENSOR 9 RCS9
I:065
11
RETURN CONVEYOR SENSOR 8 RCS8
I:065
10
RETURN CONVEYOR SENSOR 9 RCS9
I:065
11
RCM8_TMR
T4:358
DN
[25]
ng #027
TO RETURN CONVEYOR AUTO_RC
B3
700
RETURN CONVEYOR SENSOR 8 RCS8
I:065
10
RETURN CONVEYOR SENSOR 9 RCS9
I:065
11
RETURN CONVEYOR MOTOR 9 RCM9
O:073
(L)
10
O:073/10 - -| |- - File #4 RETRN_CNVR - 28
-(U)- - File #4 RETRN_CNVR - 29
RETURN CONVEYOR SENSOR 9 RCS9
I:065
11
RETURN CONVEYOR SENSOR 10 RCS10
I:065
12
Rung #028
RETURN CONVEYOR MOTOR 9 RCM9
O:073
10
RETURN CONVEYOR MOTOR 9 TIMER RCM9_TMR
TON
TIMER ON DELAY
(EN)
TIMER: T4:359
BASE (SEC): 1.0
(DN)
PRESET: 25
ACCUM: 0
T4:359.DN - -| |- - File #4 RETRN_CNVR - 29


Rung #029
RETURN CONVEYOR SENSOR 9 RCS9
I:065
11
RETURN CONVEYOR MOTOR 9 SS RCM9SS
B3
[ONS]
359
RETURN CONVEYOR MOTOR 9 RCM9
O:073
(U)
10
O:073/10 - ⊣ ⊢ - File #4 RETRN_CNVR - 28
-(L)- - File #4 RETRN_CNVR - 27
RETURN CONVEYOR SENSOR 10 RCS10
I:065
12
RETURN CONVEYOR SENSOR 9 RCS9
I:065
11
RETURN CONVEYOR SENSOR 10 RCS10
I:065
12
RCM9_TMR
T4:359
DN
[28]
Rung #030
TO RETURN CONVEYOR AUTO_RC
B3
700
RETURN CONVEYOR SENSOR 9 RCS9
I:065
11
RETURN CONVEYOR SENSOR 10 RCS10
I:065
12
RETURN CONVEYOR MOTOR 10 RCM10
O:073
(L)
11
O:073/11 - ⊣ ⊢ - File #4 RETRN_CNVR - 31
-(U)- - File #4 RETRN_CNVR - 32
RETURN CONVEYOR SENSOR 10 RCS10
I:065
12
RETURN CONVEYOR SENSOR 11 RCS11
I:065
13
Rung #031
RETURN CONVEYOR MOTOR 10 RCM10
O:073
11
[30]
RETURN CONVEYOR MOTOR 10 TIMER RCM10_TMR
TON
TIMER ON DELAY
TIMER: T4:360
BASE (SEC): 1.0
PRESET: 25
ACCUM: 9
(EN)
(DN)
T4:360.DN - ⊣ ⊢ - File #4 RETRN_CNVR - 32

Rung #032

RETURN CONVEYOR SENSOR 10 RCS10 I:065 12
RETURN CONVEYOR MOTOR 10 SS RCM10SS B3 [ONS] 360
RETURN CONVEYOR SENSOR 11 RCS11 I:065 13
RETURN CONVEYOR SENSOR 10 RCS10 I:065 12
RETURN CONVEYOR SENSOR 11 RCS11 I:065 13
RCM10_TMR T4:360 DN
[31]

RETURN CONVEYOR MOTOR 10 RCM10 O:073 (U) 11

O:073/11 - ┤ ├ - File #4 RETRN_CNVR - 31
-(L)- - File #4 RETRN_CNVR - 30

Rung #033

AUTO RETURN CONVEYOR AUTO_RC B3 700
RETURN CONVEYOR SENSOR 10 RCS10 I:065 12
RETURN CONVEYOR SENSOR 11 RCS11 I:065 ┤/├ 13
RETURN CONVEYOR SENSOR 11 RCS11 I:065 13
RETURN CONVEYOR SENSOR 12 RCS12 I:065 ┤/├ 14

RETURN CONVEYOR MOTOR 11 RCM11 O:073 (L) 12

O:073/12 - ┤ ├ - File #4 RETRN_CNVR - 34
-(U)- - File #4 RETRN_CNVR - 35

Rung #034

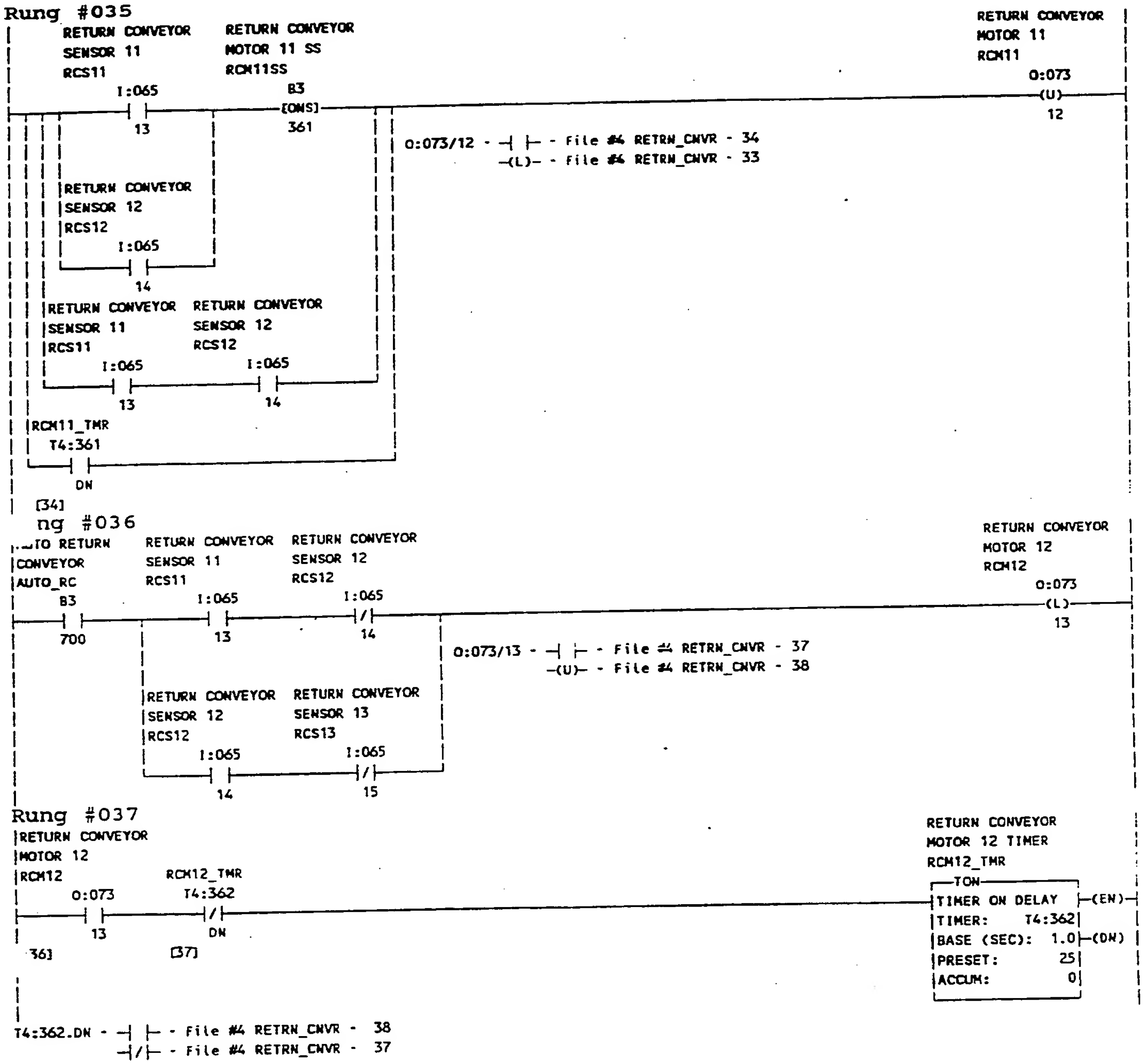
RETURN CONVEYOR MOTOR 11 RCM11 O:073 12
RCM11_TMR T4:361 ┤/├ DN
33] [34]

RETURN CONVEYOR MOTOR 11 TIMER RCM11_TMR

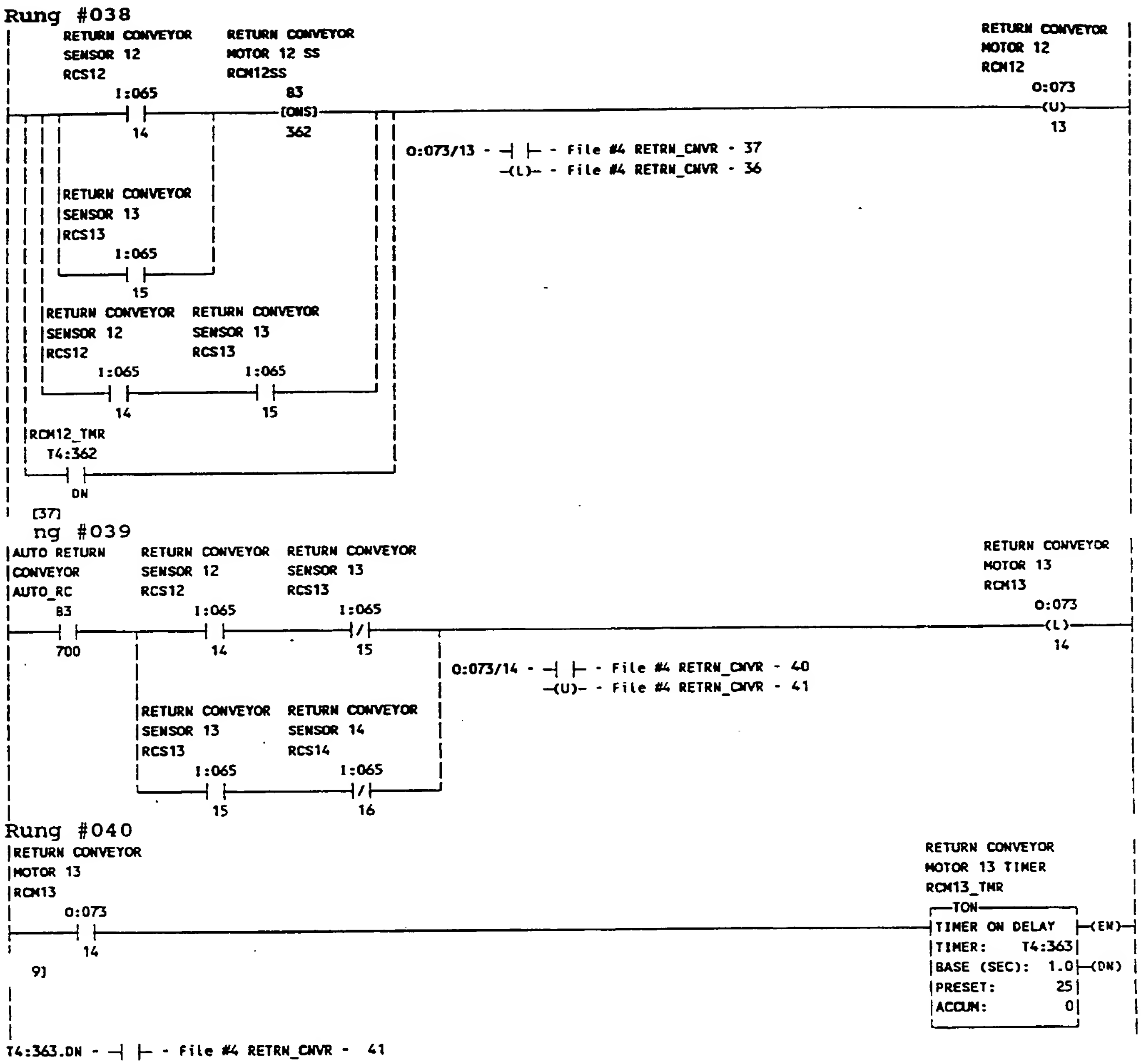
TON
TIMER ON DELAY (EN)
TIMER: T4:361
BASE (SEC): 1.0 (DN)
PRESET: 25
ACCUM: 1

T4:361.DN - ┤ ├ - File #4 RETRN_CNVR - 35
┤/├ - File #4 RETRN_CNVR - 34

590


Rung #035
RETURN CONVEYOR SENSOR 11 RCS11
I:065
13
RETURN CONVEYOR MOTOR 11 SS RCM11SS
B3
[ONS]
361
RETURN CONVEYOR MOTOR 11 RCM11
O:073
(U)
12
O:073/12 - ┤ ├ - File #4 RETRN_CNVR - 34
—(L)— - File #4 RETRN_CNVR - 33
RETURN CONVEYOR SENSOR 12 RCS12
I:065
14
RETURN CONVEYOR SENSOR 11 RCS11
I:065
13
RETURN CONVEYOR SENSOR 12 RCS12
I:065
14
RCM11_TMR
T4:361
DN
[34]
ng #036
AUTO RETURN CONVEYOR AUTO_RC
B3
700
RETURN CONVEYOR SENSOR 11 RCS11
I:065
13
RETURN CONVEYOR SENSOR 12 RCS12
I:065
14
RETURN CONVEYOR MOTOR 12 RCM12
O:073
(L)
13
O:073/13 - ┤ ├ - File #4 RETRN_CNVR - 37
—(U)— - File #4 RETRN_CNVR - 38
RETURN CONVEYOR SENSOR 12 RCS12
I:065
14
RETURN CONVEYOR SENSOR 13 RCS13
I:065
15
Rung #037
RETURN CONVEYOR MOTOR 12 RCM12
O:073
13
[36]
RCM12_TMR
T4:362
DN
[37]
RETURN CONVEYOR MOTOR 12 TIMER RCM12_TMR
TON
TIMER ON DELAY
(EN)
TIMER: T4:362
BASE (SEC): 1.0
(DN)
PRESET: 25
ACCUM: 0
T4:362.DN - ┤ ├ - File #4 RETRN_CNVR - 38
┤/├ - File #4 RETRN_CNVR - 37

591



Rung #038
RETURN CONVEYOR SENSOR 12 RCS12 I:065 14
RETURN CONVEYOR MOTOR 12 SS RCM12SS B3 [ONS] 362
RETURN CONVEYOR SENSOR 13 RCS13 I:065 15
RETURN CONVEYOR SENSOR 12 RCS12 I:065 14
RETURN CONVEYOR SENSOR 13 RCS13 I:065 15
RCM12_TMR T4:362 DN
RETURN CONVEYOR MOTOR 12 RCM12 O:073 (U) 13
O:073/13 - ┤ ├ - File #4 RETRN_CNVR - 37
-(L)- - File #4 RETRN_CNVR - 36
[37]
ng #039
AUTO RETURN CONVEYOR AUTO_RC B3 700
RETURN CONVEYOR SENSOR 12 RCS12 I:065 14
RETURN CONVEYOR SENSOR 13 RCS13 I:065 15
RETURN CONVEYOR SENSOR 13 RCS13 I:065 15
RETURN CONVEYOR SENSOR 14 RCS14 I:065 16
RETURN CONVEYOR MOTOR 13 RCM13 O:073 (L) 14
O:073/14 - ┤ ├ - File #4 RETRN_CNVR - 40
-(U)- - File #4 RETRN_CNVR - 41
Rung #040
RETURN CONVEYOR MOTOR 13 RCM13 O:073 14
9]
RETURN CONVEYOR MOTOR 13 TIMER RCM13_TMR
TON
TIMER ON DELAY (EN)
TIMER: T4:363
BASE (SEC): 1.0 (DN)
PRESET: 25
ACCUM: 0
T4:363.DN - ┤ ├ - File #4 RETRN_CNVR - 41

592

Rung #041

RETURN CONVEYOR SENSOR 13 RCS13 I:065 15

RETURN CONVEYOR MOTOR 13 SS RCM13SS B3 [ONS] 363

RETURN CONVEYOR MOTOR 13 RCM13 O:073 (U) 14

O:073/14 - ┤├ - File #4 RETRN_CNVR - 40
-(L)- - File #4 RETRN_CNVR - 39

RETURN CONVEYOR SENSOR 14 RCS14 I:065 16

RETURN CONVEYOR SENSOR 13 RCS13 I:065 15

RETURN CONVEYOR SENSOR 14 RCS14 I:065 16

RCM13_TMR T4:363 DN

[40]

:ng #042

AUTO RETURN CONVEYOR AUTO_RC B3 700

RETURN CONVEYOR SENSOR 13 RCS13 I:065 15

RETURN CONVEYOR SENSOR 14 RCS14 I:065 /16

RETURN CONVEYOR MOTOR 14 RCM14 O:073 (L) 15

O:073/15 - ┤├ - File #4 RETRN_CNVR - 43
-(U)- - File #4 RETRN_CNVR - 44

RETURN CONVEYOR SENSOR 14 RCS14 I:065 16

RETURN CONVEYOR SENSOR 15 RCS15 I:065 /17

Rung #043

RETURN CONVEYOR MOTOR 14 RCM14 O:073 15

RETURN CONVEYOR MOTOR 14 TIMER RCM14_TMR

TON
TIMER ON DELAY (EN)
TIMER: T4:364
BASE (SEC): 1.0 (DN)
PRESET: 25
ACCUM: 0

:42]

T4:364.DN - ┤├ - File #4 RETRN_CNVR - 44

```
Rung #044
|    RETURN CONVEYOR      RETURN CONVEYOR                                          RETURN CONVEYOR |
|    SENSOR 14            MOTOR 14 SS                                              MOTOR 14        |
|    RCS14                RCM14SS                                                  RCM14           |
|           I:065               B3                                                     O:073      |
|-+-+-+-------| |--------+--------[ONS]--------+-+------------------------------------------(U)----|
| | | |         16       |         364         | |                                        15       |
| | | |                  |                     | | O:073/15 - -| |- - File #4 RETRN_CNVR - 43      |
| | | |                  |                     | |            -(L)- - File #4 RETRN_CNVR - 42      |
| | | |RETURN CONVEYOR   |                     | |                                                 |
| | | |SENSOR 15         |                     | |                                                 |
| | | |RCS15             |                     | |                                                 |
| | | |       I:065      |                     | |                                                 |
| | | +--------| |-------+                     | |                                                 |
| | |          17                              | |                                                 |
| | |RETURN CONVEYOR   RETURN CONVEYOR         | |                                                 |
| | |SENSOR 14         SENSOR 15               | |                                                 |
| | |RCS14             RCS15                   | |                                                 |
| | |      I:065            I:065              | |                                                 |
| | +--------| |--------------| |--------------+ |                                                 |
| |          16               17                 |                                                 |
| |RCM14_TMR                                     |                                                 |
| |  T4:364                                      |                                                 |
| +-----| |--------------------------------------+                                                 |
|        DN                                                                                        |
| [43]                                                                                             |
  ng #045
|AUTO RETURN      RETURN CONVEYOR    RETURN CONVEYOR                               RETURN CONVEYOR |
|CONVEYOR         SENSOR 14          SENSOR 15                                     MOTOR 15        |
|AUTO_RC          RCS14              RCS15                                         RCM15           |
|   B3                  I:065              I:065                                      O:073        |
|-----| |-------+---------| |----------------|/|-----+-------------------------------------(L)-----|
|      700      |          16                 17     |                                  16         |
|               |                                    | O:073/16 - -| |- - File #4 RETRN_CNVR - 46  |
|               |                                    |            -(U)- - File #4 RETRN_CNVR - 47  |
|               |RETURN CONVEYOR    RETURN CONVEYOR  |                                             |
|               |SENSOR 15          SENSOR 16        |                                             |
|               |RCS15              RCS16            |                                             |
|               |        I:065             I:066     |                                             |
|               +----------| |---------------|/|----+                                             |
|                          17                00                                                   |
Rung #046
|RETURN CONVEYOR                                                             RETURN CONVEYOR       |
|MOTOR 15                                                                    MOTOR 15 TIMER        |
|RCM15                                                                       RCM15_TMR             |
|    O:073                                                                   +-TON-------------+   |
|------| |-------------------------------------------------------------------|TIMER ON DELAY   |-(EN)-|
|        16                                                                  |TIMER:    T4:365 |   |
| [5]                                                                        |BASE (SEC):  1.0 |-(DN) |
|                                                                            |PRESET:       25 |   |
|                                                                            |ACCUM:         0 |   |
|                                                                            +-----------------+   |
T4:365.DN - -| |- - File #4 RETRN_CNVR - 47
```

Rung #047

RETURN CONVEYOR SENSOR 15 RCS15 I:065 17

RETURN CONVEYOR MOTOR 15 SS RCM15SS B3 [ONS] 365

RETURN CONVEYOR MOTOR 15 RCM15 0:073 (U) 16

0:073/16 - ┤ ├ - File #4 RETRN_CNVR - 46
-(L)- - File #4 RETRN_CNVR - 45

RETURN CONVEYOR SENSOR 16 RCS16 I:066 00

RETURN CONVEYOR SENSOR 15 RCS15 I:065 17

RETURN CONVEYOR SENSOR 16 RCS16 I:066 00

RCM15_TMR T4:365 DN

[46]

Rung #048

AUTO RETURN CONVEYOR AUTO_RC B3 700

RETURN CONVEYOR SENSOR 15 RCS15 I:065 17

RETURN CONVEYOR SENSOR 16 RCS16 I:066 /00

RETURN CONVEYOR MOTOR 16 RCM16 0:073 (L) 17

0:073/17 - ┤ ├ - File #4 RETRN_CNVR - 49
-(U)- - File #4 RETRN_CNVR - 50

RETURN CONVEYOR SENSOR 16 RCS16 I:066 00

RETURN CONVEYOR SENSOR 17 RCS17 I:066 /01

Rung #049

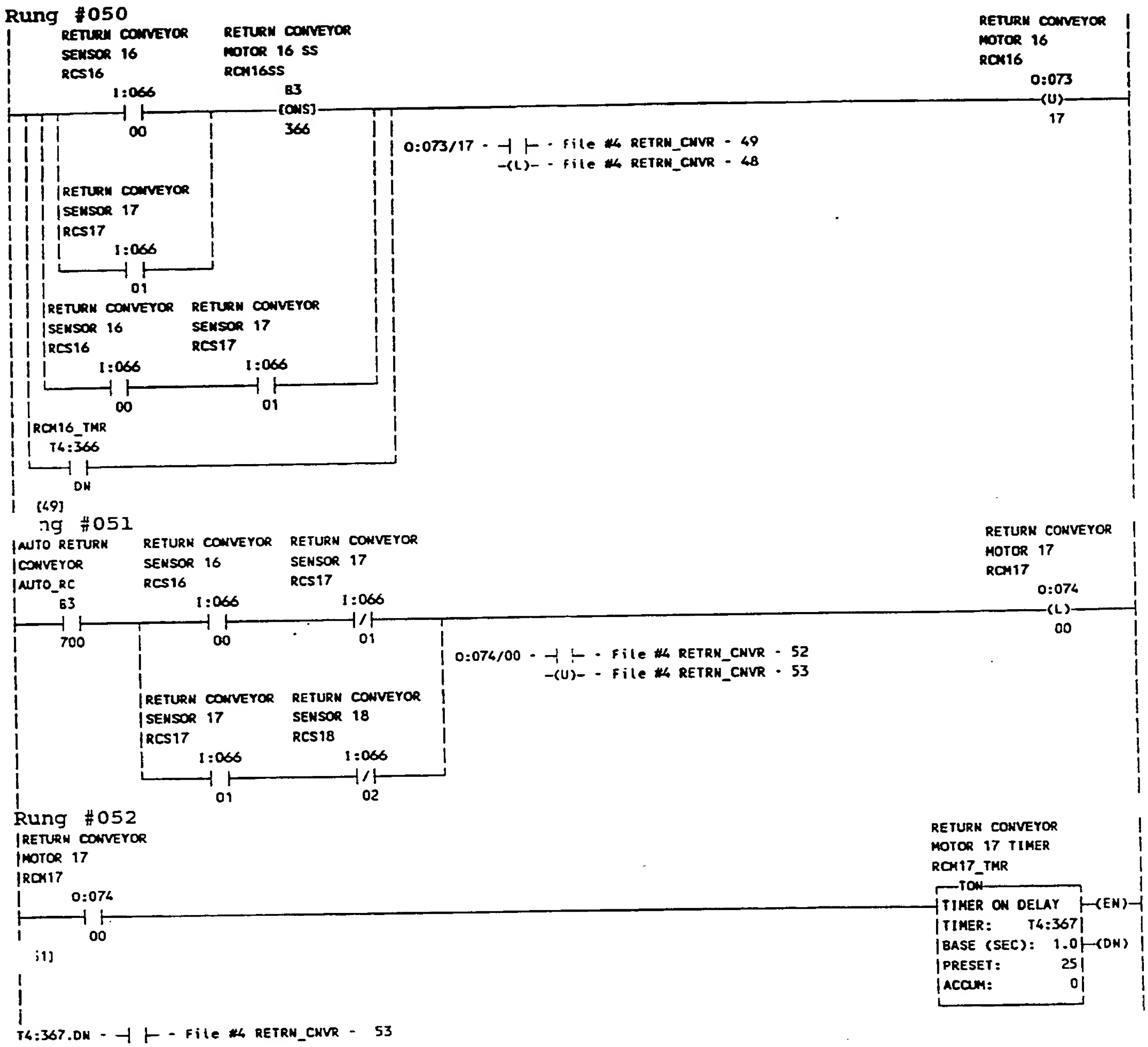
RETURN CONVEYOR MOTOR 16 RCM16 0:073 17

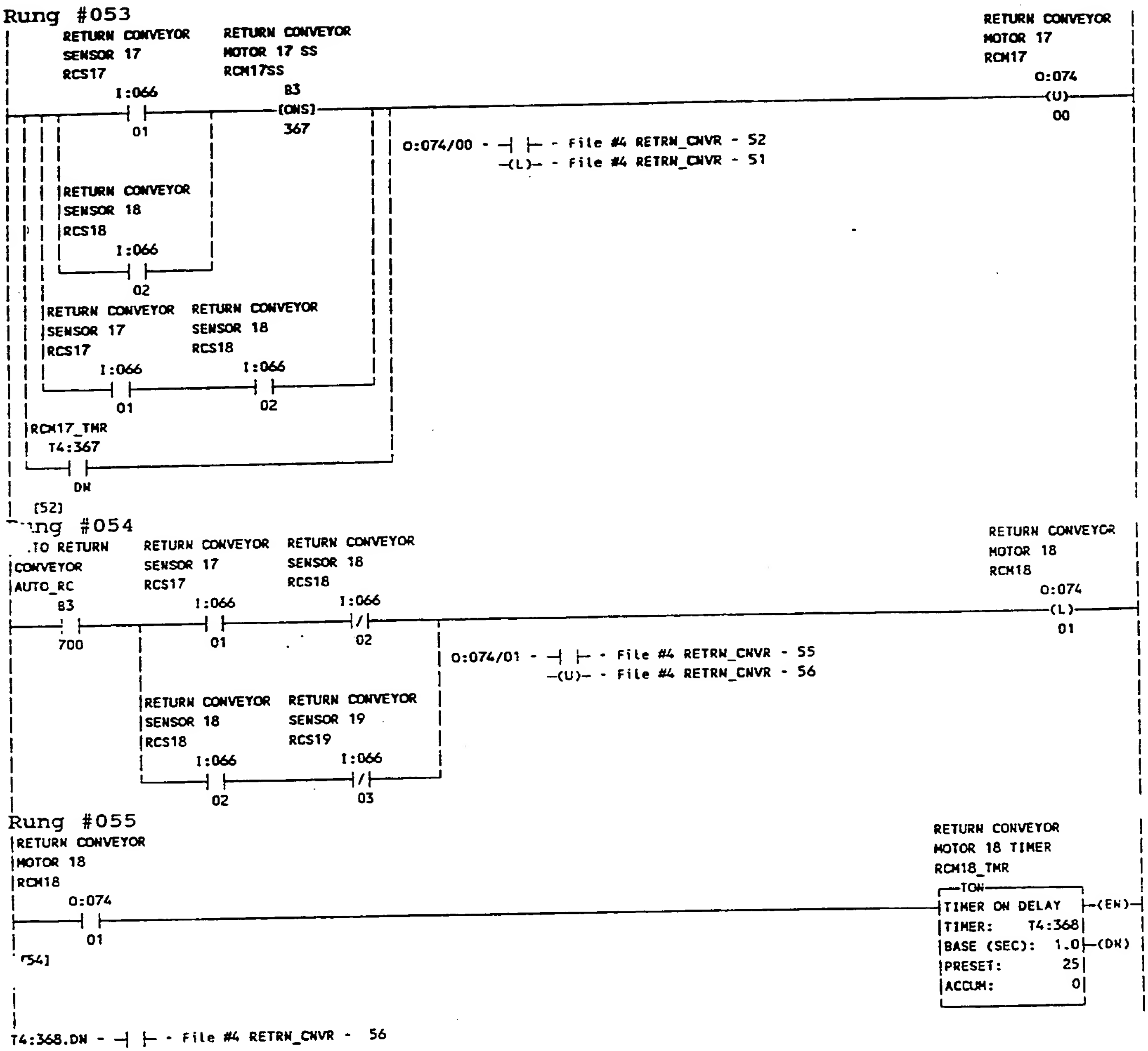
8]

RETURN CONVEYOR MOTOR 16 TIMER RCM16_TMR

TON
TIMER ON DELAY (EN)
TIMER: T4:366
BASE (SEC): 1.0 (DN)
PRESET: 25
ACCUM: 0

T4:366.DN - ┤ ├ - File #4 RETRN_CNVR - 50


Rung #050
RETURN CONVEYOR SENSOR 16 RCS16
1:066
00
RETURN CONVEYOR MOTOR 16 SS RCM16SS
B3
[ONS]
366
RETURN CONVEYOR MOTOR 16 RCM16
0:073
(U)
17
0:073/17 -] [- File #4 RETRN_CNVR - 49
-(L)- - File #4 RETRN_CNVR - 48
RETURN CONVEYOR SENSOR 17 RCS17
1:066
01
RETURN CONVEYOR SENSOR 16 RCS16
1:066
00
RETURN CONVEYOR SENSOR 17 RCS17
1:066
01
RCM16_TMR
T4:366
DN
[49]
ng #051
AUTO RETURN CONVEYOR AUTO_RC
B3
700
RETURN CONVEYOR SENSOR 16 RCS16
1:066
00
RETURN CONVEYOR SENSOR 17 RCS17
1:066
01
RETURN CONVEYOR MOTOR 17 RCM17
0:074
(L)
00
0:074/00 -] [- File #4 RETRN_CNVR - 52
-(U)- - File #4 RETRN_CNVR - 53
RETURN CONVEYOR SENSOR 17 RCS17
1:066
01
RETURN CONVEYOR SENSOR 18 RCS18
1:066
02
Rung #052
RETURN CONVEYOR MOTOR 17 RCM17
0:074
00
;1]
RETURN CONVEYOR MOTOR 17 TIMER RCM17_TMR
TON
TIMER ON DELAY
TIMER: T4:367
BASE (SEC): 1.0
PRESET: 25
ACCUM: 0
(EN)
(DN)
T4:367.DN -] [- File #4 RETRN_CNVR - 53


Rung #053
RETURN CONVEYOR SENSOR 17 RCS17
RETURN CONVEYOR MOTOR 17 SS RCM17SS
RETURN CONVEYOR MOTOR 17 RCM17
I:066
01
B3
[ONS]
367
0:074
(U)
00
0:074/00 - ┤ ├ - File #4 RETRN_CNVR - 52
-(L)- - File #4 RETRN_CNVR - 51
RETURN CONVEYOR SENSOR 18 RCS18
I:066
02
RETURN CONVEYOR SENSOR 17 RCS17
RETURN CONVEYOR SENSOR 18 RCS18
I:066
01
I:066
02
RCM17_TMR
T4:367
DN
[52]
Rung #054
AUTO RETURN CONVEYOR AUTO_RC
B3
700
RETURN CONVEYOR SENSOR 17 RCS17
I:066
01
RETURN CONVEYOR SENSOR 18 RCS18
I:066
02
RETURN CONVEYOR MOTOR 18 RCM18
0:074
(L)
01
0:074/01 - ┤ ├ - File #4 RETRN_CNVR - 55
-(U)- - File #4 RETRN_CNVR - 56
RETURN CONVEYOR SENSOR 18 RCS18
I:066
02
RETURN CONVEYOR SENSOR 19 RCS19
I:066
03
Rung #055
RETURN CONVEYOR MOTOR 18 RCM18
0:074
01
[54]
RETURN CONVEYOR MOTOR 18 TIMER RCM18_TMR
TON
TIMER ON DELAY
(EN)
TIMER: T4:368
BASE (SEC): 1.0
(DN)
PRESET: 25
ACCUM: 0
T4:368.DN - ┤ ├ - File #4 RETRN_CNVR - 56

597

Rung #056

RETURN CONVEYOR SENSOR 18 RCS18 I:066 02 — RETURN CONVEYOR MOTOR 18 SS RCM18SS B3 [ONS] 368 — RETURN CONVEYOR MOTOR 18 RCM18 O:074 (U) 01

RETURN CONVEYOR SENSOR 19 RCS19 I:066 03

RETURN CONVEYOR SENSOR 18 RCS18 I:066 02 — RETURN CONVEYOR SENSOR 19 RCS19 I:066 03

RCM18_TMR T4:368 DN

[55]

O:074/01 - -| |- - File #4 RETRN_CNVR - 55
-(L)- - File #4 RETRN_CNVR - 54

Rung #057

AUTO RETURN CONVEYOR AUTO_RC B3 700 — RETURN CONVEYOR SENSOR 18 RCS18 I:066 02 — RETURN CONVEYOR SENSOR 19 RCS19 I:066 -|/|- 03 — RETURN CONVEYOR MOTOR 19 RCM19 O:074 (L) 02

RETURN CONVEYOR SENSOR 19 RCS19 I:066 03 — RETURN CONVEYOR SENSOR 20 RCS20 I:066 -|/|- 04

O:074/02 - -| |- - File #4 RETRN_CNVR - 58
-(U)- - File #4 RETRN_CNVR - 59

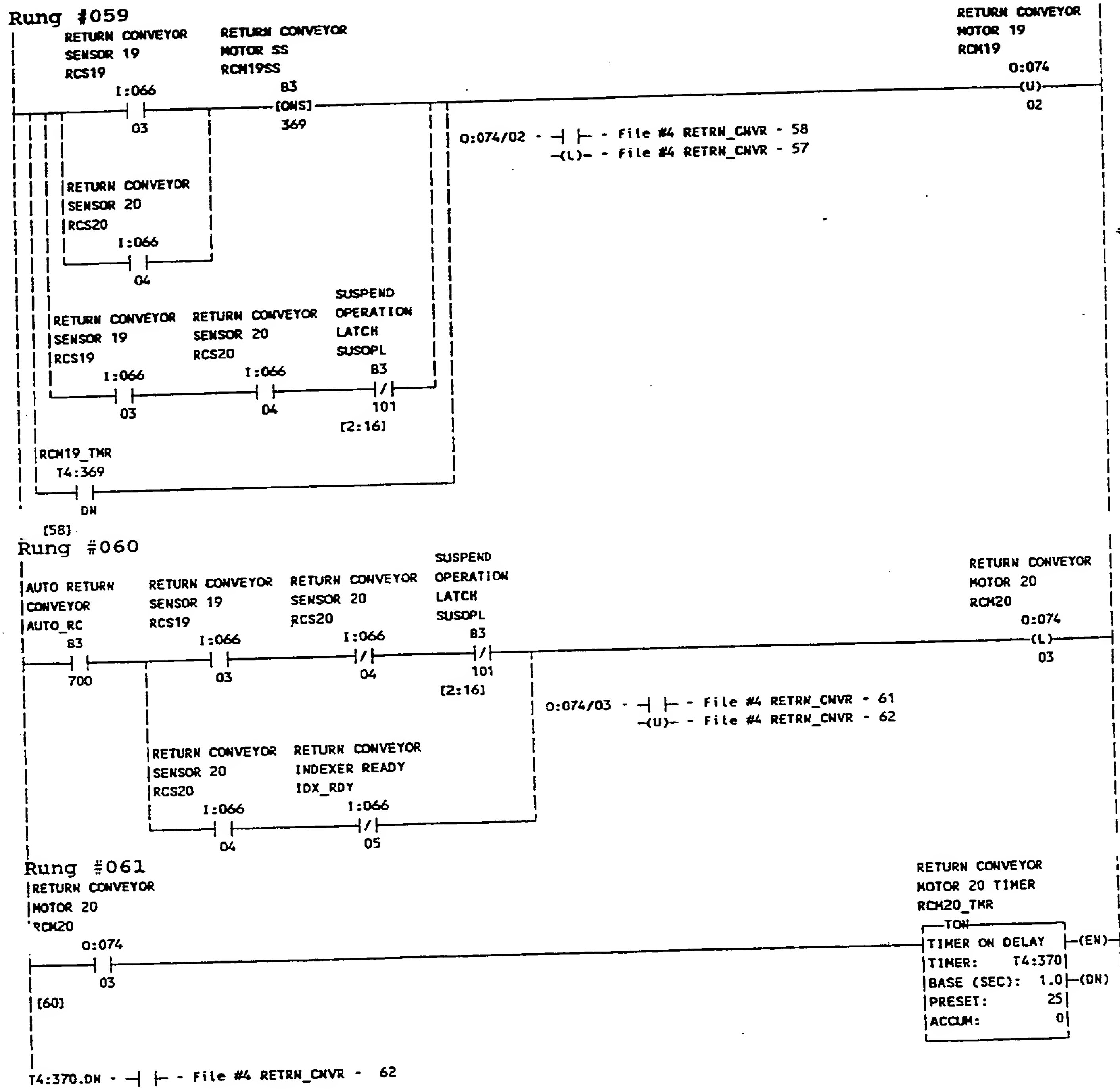
Rung #058

RETURN CONVEYOR MOTOR 19 RCM19 O:074 02 — RETURN CONVEYOR MOTOR 19 TIMER RCM19_TMR

TON
TIMER ON DELAY (EN)
TIMER: T4:369
BASE (SEC): 1.0 (DN)
PRESET: 25
ACCUM: 0

[57]

T4:369.DN - -| |- - File #4 RETRN_CNVR - 59


Rung #059
RETURN CONVEYOR SENSOR 19 RCS19
I:066
03
RETURN CONVEYOR MOTOR SS RCM19SS
B3
[ONS]
369
RETURN CONVEYOR MOTOR 19 RCM19
O:074
(U)
02
O:074/02 - ┤ ├ - File #4 RETRN_CNVR - 58
-(L)- - File #4 RETRN_CNVR - 57
RETURN CONVEYOR SENSOR 20 RCS20
I:066
04
RETURN CONVEYOR SENSOR 19 RCS19
I:066
03
RETURN CONVEYOR SENSOR 20 RCS20
I:066
04
SUSPEND OPERATION LATCH SUSOPL
B3
101
[2:16]
RCM19_TMR
T4:369
DN
[58]
Rung #060
AUTO RETURN CONVEYOR AUTO_RC
B3
700
RETURN CONVEYOR SENSOR 19 RCS19
I:066
03
RETURN CONVEYOR SENSOR 20 RCS20
I:066
04
SUSPEND OPERATION LATCH SUSOPL
B3
101
[2:16]
RETURN CONVEYOR MOTOR 20 RCM20
O:074
(L)
03
O:074/03 - ┤ ├ - File #4 RETRN_CNVR - 61
-(U)- - File #4 RETRN_CNVR - 62
RETURN CONVEYOR SENSOR 20 RCS20
I:066
04
RETURN CONVEYOR INDEXER READY IDX_RDY
I:066
05
Rung #061
RETURN CONVEYOR MOTOR 20 RCM20
O:074
03
[60]
RETURN CONVEYOR MOTOR 20 TIMER RCM20_TMR
TON
TIMER ON DELAY
TIMER: T4:370
BASE (SEC): 1.0
PRESET: 25
ACCUM: 0
(EN)
(DN)
T4:370.DN - ┤ ├ - File #4 RETRN_CNVR - 62

599

```
Rung #062                                                                    RETURN CONVEYOR  |
|                                                                            MOTOR 20         |
|                                                                            RCM20            |
|RCM20_TMR                                                                        O:074       |
| T4:370                                                                                      |
|----| |---------------------------------------------------------------------------(U)--------|
|     DN                                                                            03        |
|                                                                                             |
|[61]
O:074/03 - -| |- - File #4 RETRN_CNVR -  61
           -(L)- - File #4 RETRN_CNVR -  60
           -(U)- - File #4 RETRN_CNVR -  62
Rung #063                                                                    RETURN CONVEYOR  |
|                                                                            INDEXER MOTOR    |
|AUTO RETURN   RETURN CONVEYOR   RETURN CONVEYOR                             LATCH            |
|CONVEYOR      SENSOR 20         INDEXER READY                               RCIML            |
|AUTO_RC       RCS20             IDX_RDY                                          B3          |
|    B3             I:066             I:066                                                   |
|----| |-------------| |---------------| |------------------------------------------(L)--------|
|    700             04                05                                          372        |
B3/372 - -| |- - File #4 RETRN_CNVR -  65
         -|/|- - File #4 RETRN_CNVR -  64
         -(L)- - File #4 RETRN_CNVR -  63
         -(U)- - File #4 RETRN_CNVR -  66
Rung #064                                                                    RETURN CONVEYOR  |
|RETURN CONVEYOR                                                             INDEXER MOTOR    |
|INDEXER MOTOR                                                               START            |
  ATCH                                                                       RCIMS            |
  CIML                                                                            O:076       |
|      B3                                                                                     |
|-----|/|----------------------------------------------------------------------------( )------|
|      372                                                                          00        |
|[63]                                                                                         |
Rung #065                                                                   RETURN CONVEYOR   |
|RETURN CONVEYOR                                                            INDEXER MOTOR     |
|INDEXER MOTOR                                                              TIMER             |
|LATCH                                                                      RCIM_TMR          |
|RCIML                                                                      +-TON-----------+ |
|      B3                                                                   |TIMER ON DELAY |-(EN)-|
|-----| |-------------------------------------------------------------------|TIMER:  T4:340 |      |
|      372                                                                  |BASE (SEC): 1.0|-(DN) |
|[66]                                                                       |PRESET:      15|      |
|                                                                           |ACCUM:        0|      |
|                                                                           +---------------+      |
T4:340.DN - -| |- - File #4 RETRN_CNVR -  66
Rung #066                                                                    RETURN CONVEYOR  |
|                                                                            INDEXER MOTOR    |
|                                                                            LATCH            |
|RCIM_TMR                                                                    RCIML            |
| T4:340                                                                          B3          |
|----| |----------------------------------------------------------------------------(U)-------|
|     DN                                                                            372       |
|[65]                                                                                         |
B3/372 - -| |- - File #4 RETRN_CNVR -  65
         -|/|- - File #4 RETRN_CNVR -  64
         -(L)- - File #4 RETRN_CNVR -  63
         -(U)- - File #4 RETRN_CNVR -  66
Rung #067                                                                   +-RET----------+ |
|                                                                           |RETURN ()     |-|
|---------------------------------------------------------------------------+--------------+ |
|
```

600

Rung #068

[END]

```
Rung #000
|AUTO                                                    MOTOR 3
|MODE      MOTOR 3   PAUSE                               FAULT
|ENABLE    FAST      DISABLE                             TIMER
|AUTO      M3F       TS12                                M3FLT
| N7:37     O:012     N7:16                              +-TON-----------------+
|-| |--------| |--------|/|--------------------------------|TIMER ON DELAY      |-(EN)-|
|  11        12        4                                 |TIMER:      T4:303|
|[2:158]  [2:185]   [2:3]                                |BASE (SEC):   1.0|-(DN)
|                                                        |PRESET:       100|
|                                                        |ACCUM:          0|
|                                                        +------------------+
T4:303.DN - ┤ ├ - File #5 FAULTS - 15

Rung #001
|AUTO                                                    MOTOR 4
|MODE      MOTOR 4   PAUSE                               FAULT
|ENABLE    FAST      DISABLE                             TIMER
|AUTO      M4F       TS12                                M4FLT
| N7:37     O:012     N7:16                              +-TON-----------------+
|-| |--------| |--------|/|--------------------------------|TIMER ON DELAY      |-(EN)-|
|  11        13        4                                 |TIMER:      T4:304|
|[2:158]  [2:190]   [2:3]                                |BASE (SEC):   1.0|-(DN)
|                                                        |PRESET:       100|
|                                                        |ACCUM:          0|
|                                                        +------------------+
T4:304.DN - ┤ ├ - File #5 FAULTS - 15

Rung #002
 JTO                                                     MOTOR 5
|MODE      MOTOR 5   PAUSE                               FAULT
|ENABLE    FAST      DISABLE                             TIMER
|AUTO      M5F       TS12                                M5FLT
| N7:37     O:012     N7:16                              +-TON-----------------+
|-| |--------| |--------|/|--------------------------------|TIMER ON DELAY      |-(EN)-|
|  11        14        4                                 |TIMER:      T4:305|
|[2:158]  [2:195]   [2:3]                                |BASE (SEC):   1.0|-(DN)
|                                                        |PRESET:       100|
|                                                        |ACCUM:          0|
|                                                        +------------------+
T4:305.DN - ┤ ├ - File #5 FAULTS - 15

Rung #003
|AUTO                                                    MOTOR 6 OR 7
|MODE       MOTOR 6      PAUSE                           FAULT
|ENABLE     FAST         DISABLE                         TIMER
|AUTO       M6F          TS12                            M6,7FLT
| N7:37      O:012        N7:16                          +-TON-----------------+
|-| |----+----| |----+----|/|----------------------------|TIMER ON DELAY      |-(EN)-|
|  11    |    15     |     4                             |TIMER:      T4:306|
|[2:158] |[2:218]    |  [2:3]                            |BASE (SEC):   1.0|-(DN)
|        |           |                                   |PRESET:       200|
|        |           |                                   |ACCUM:         62|
|        |MOTOR 7    |                                   +------------------+
|        |FAST       |
|        |M7F        |
|        |  O:012    |
|        +----| |----+
|             16
|          [2:231]
T4:306.DN - ┤ ├ - File #5 FAULTS - 15
```

602

```
Rung #004
|AUTO                                                             MOTOR 8
|MODE     MOTOR 8  PAUSE                                          FAULT TIMER
|ENABLE   FAST     DISABLE                                        M8FLT
|AUTO     M8F      TS12                                          +-TON-----------------+
| N7:37    O:012    N7:16                                        |TIMER ON DELAY       |-(EN)-
|--| |-----| |-----|/|-------------------------------------------|TIMER:       T4:335  |
|  11       17       4                                           |BASE (SEC):     1.0  |-(DN)
| [2:158]  [2:249]  [2:3]                                        |PRESET:         200  |
|                                                                |ACCUM:            4  |
|                                                                +---------------------+
T4:335.DN - -| |- - File #5 FAULTS -  15

Rung #005
|AUTO                                                             MOTOR 9
|MODE     MOTOR 9  PAUSE                                          FAULT FAULT
|ENABLE   FAST     DISABLE                                        M9FLT
|AUTO     M9F      TS12                                          +-TON-----------------+
| N7:37    O:032    N7:16                                        |TIMER ON DELAY       |-(EN)-
|--| |-----| |-----|/|-------------------------------------------|TIMER:       T4:307  |
|  11       10       4                                           |BASE (SEC):     1.0  |-(DN)
| [2:158]  [2:253]  [2:3]                                        |PRESET:         150  |
|                                                                |ACCUM:            0  |
|                                                                +---------------------+
T4:307.DN - -| |- - File #5 FAULTS -  15

Rung #006
  O                                                               MOTOR 10 OR 11
|MODE       MOTOR 10     PAUSE                                    FAULT
|ENABLE     FAST         DISABLE                                  TIMER
|AUTO       M10F         TS12                                     M10,11FLT
| N7:37       O:032        N7:16                                 +-TON-----------------+
|--| |----+----| |----+----|/|------------------------------------|TIMER ON DELAY       |-(EN)-
|  11      |    11     |    4                                    |TIMER:       T4:308  |
| [2:158]  | [2:258]   |  [2:3]                                  |BASE (SEC):     1.0  |-(DN)
|          |           |                                         |PRESET:         200  |
|          |           |                                         |ACCUM:            0  |
|          |MOTOR 11   |                                         +---------------------+
|          |FAST       |
|          |M11F       |
|          |  O:032    |
|          +----| |----+
|              12
|           [2:263]
T4:308.DN - -| |- - File #5 FAULTS -  15

Rung #007
|AUTO                                                             MOTOR 12
|MODE     MOTOR 12  PAUSE                                         FAULT TIMER
|ENABLE   FAST      DISABLE                                       M12FLT
|AUTO     M12F      TS12                                         +-TON-----------------+
| N7:37    O:032     N7:16                                       |TIMER ON DELAY       |-(EN)-
|--| |-----| |------|/|------------------------------------------|TIMER:       T4:336  |
|  11       13        4                                          |BASE (SEC):     1.0  |-(DN)
| [2:158]  [2:281]   [2:3]                                       |PRESET:         200  |
|                                                                |ACCUM:            0  |
|                                                                +---------------------+
T4:336.DN - -| |- - File #5 FAULTS -  15
```

603

Rung #008

```
|AUTO
|MODE    MOTOR 13  PAUSE                                         MOTOR 13
|ENABLE  FAST      DISABLE                                       FAULT TIMER
|AUTO    M13F      TS12                                          M13FLT
| N7:37   O:032     N7:16                                        +-TON----------------+
|-] [----] [-------]/[-------------------------------------------+TIMER ON DELAY      +-(EN)-
|  11      14        4                                           |TIMER:      T4:309|
|[2:158] [2:285]   [2:3]                                         |BASE (SEC):  1.0+-(DN)
|                                                                |PRESET:       150|
|                                                                |ACCUM:          0|
|                                                                +------------------+
```

T4:309.DN -] [- File #5 FAULTS - 15

Rung #009

```
|                                  PALLET
|AUTO                              DETECTED
|MODE     MOTOR 14     PAUSE       RIGHT SIDE                    MOTOR 14 OR 15
|ENABLE   FAST         DISABLE     CARBON                        FAULT TIMER
|AUTO     M14F         TS12        SEN42                         M14,15FLT
| N7:37     O:032        N7:16       I:053                       +-TON----------------+
|-] [---+---] [---+------]/[---------]/[-------------------------+TIMER ON DELAY      +-(EN)-
|  11   |    15   |       4           02                         |TIMER:      T4:310|
|[2:158]|[2:290]  |    [2:3]                                     |BASE (SEC):  1.0+-(DN)
|       |         |                                              |PRESET:       180|
|       |         |                                              |ACCUM:         47|
|       |         |                                              +------------------+
|       |MOTOR 15 |
|       |FAST     |
|       |M15F     |
|       |  O:032  |
|       +---] [---+
|          16
|        [2:295]
```

T4:310.DN -] [- File #5 FAULTS - 15

Rung #010

```
|                              PALLET
|AUTO                          DETECTED
|MODE     MOTOR 16  PAUSE      RIGHT SIDE                        MOTOR 16
|ENABLE   FAST      DISABLE    DWELL 6                           FAULT TIMER
|AUTO     M16F      TS12       SEN45                             M16FLT
| N7:37    O:032     N7:16      I:053                            +-TON----------------+
|-] [-----] [-------]/[--------]/[-------------------------------+TIMER ON DELAY      +-(EN)-
|  11       17        4          05                              |TIMER:      T4:337|
|[2:158] [2:306]   [2:3]                                         |BASE (SEC):  1.0+-(DN)
|                                                                |PRESET:       120|
|                                                                |ACCUM:         15|
|                                                                +------------------+
```

T4:337.DN -] [- File #5 FAULTS - 15

Rung #011

```
|                              PALLET
|AUTO                          DETECTED
|MODE     MOTOR 17  PAUSE      RIGHT SIDE                        MOTOR 17
|ENABLE   FAST      DISABLE    BUFFER 4                          FAULT TIMER
|AUTO     M17F      TS12       SEN48                             M17FLT
| N7:37    O:062     N7:16      I:053                            +-TON----------------+
|-] [-----] [-------]/[--------]/[-------------------------------+TIMER ON DELAY      +-(EN)-
|  11       10        4          10                              |TIMER:      T4:311|
|[2:158] [2:310]   [2:3]                                         |BASE (SEC):  1.0+-(DN)
|                                                                |PRESET:       130|
|                                                                |ACCUM:          0|
|                                                                +------------------+
```

T4:311.DN -] [- File #5 FAULTS - 15

604

```
Rung #012
|AUTO                                                          MOTOR 18 OR 19
|MODE     MOTOR 18    PAUSE                                    FAULT TIMER
|ENABLE   FAST        DISABLE                                  M18,19FLT
|AUTO     M18F        TS12                                     +-TON-----------------+
| N7:37    O:062       N7:16                                   |TIMER ON DELAY       |-(EN)-
|--| |----+--| |-----+---|/|-----------------------------------|TIMER:       T4:312  |
|   11    |   11     |    4                                    |BASE (SEC):     1.0  |-(DN)
|[2:158]  |[2:315]   |  [2:3]                                  |PRESET:         100  |
|         |          |                                         |ACCUM:           30  |
|         |          |                                         +---------------------+
|         |MOTOR 19  |
|         |FAST      |
|         |M19F      |
|         |  O:062   |
|         +--| |-----+
|            12
|          [2:320]
T4:312.DN - -| |- - File #5 FAULTS -  15
Rung #013
|AUTO                                                          MOTOR 20
|MODE     MOTOR 20  PAUSE                                      FAULT TIMER
|ENABLE   FAST      DISABLE                                    M20FLT
|AUTO     M20F      TS12                                       +-TON-----------------+
| N7:37    O:062     N7:16                                     |TIMER ON DELAY       |-(EN)-
  -| |------| |-------|/|--------------------------------------|TIMER:       T4:313  |
    11       13        4                                       |BASE (SEC):     1.0  |-(DN)
|[2:158] [2:331]    [2:3]                                      |PRESET:         100  |
|                                                              |ACCUM:            0  |
|                                                              +---------------------+
T4:313.DN - -| |- - File #5 FAULTS -  15
Rung #014
|AUTO                                                          MOTOR 21
|MODE     MOTOR 21  PAUSE                                      FAULT TIMER
|ENABLE   FAST      DISABLE                                    M21FLT
|AUTO     M21F      TS12                                       +-TON-----------------+
| N7:37    O:062     N7:16                                     |TIMER ON DELAY       |-(EN)-
|--| |------| |-------|/|--------------------------------------|TIMER:       T4:314  |
|   11       14        4                                       |BASE (SEC):     1.0  |-(DN)
|[2:158] [2:355]    [2:3]                                      |PRESET:         100  |
|                                                              |ACCUM:            0  |
|                                                              +---------------------+
T4:314.DN - -| |- - File #5 FAULTS -  15
```

Rung #015

```
MOTOR FAULT
TIMER DONE
MOTOR_FLT
B3
-(L)-
811

M3FLT
T4:303
-| |-
DN
[0]

B3/811 - -| |- - File #2 MAIN_PRGRM - 626
         -(U)- - File #5 FAULTS - 16

M4FLT
T4:304
-| |-
DN
[1]

M5FLT
T4:305
-| |-
DN
[2]

M6,7FLT
T4:306
-| |-
DN
[3]

M8FLT
T4:335
-| |-
DN
[4]

M9FLT
T4:307
-| |-
DN
[5]

M10,11FLT
T4:308
-| |-
DN
[6]

M12FLT
T4:336
-| |-
DN
[7]

M13FLT
T4:309
-| |-
DN
[8]

M14,15FLT
T4:310
-| |-
DN
[9]

M16FLT
T4:337
-| |-
DN
[10]
```

606

```
Rung #016
|PAUSE                                                          MOTOR FAULT |
|DISABLE                                                        TIMER DONE  |
|TS12                                                           MOTOR_FLT   |
|  N7:16                                                            B3      |
|----] [--------------------------------------------------------------(U)----|
|     4                                                             811     |
|[2:3]
B3/811 - ] [ - File #2 MAIN_PRGRM - 626
        -(L)- - File #5 FAULTS - 15
        -(U)- - File #5 FAULTS - 16
Rung #017
|DOOR CLOSE                                           DOOR 1               |
|SOLENOID                                             CLOSE                |
|1 ENABLE                                             TIMER                |
|DRCL1                                                D1CLTMR              |
|   O:011                                             +-TON---------------+ |
|----] [----------------------------------------------|TIMER ON DELAY     |-(EN)-|
|      00                                              |TIMER:       T4:81 |      |
|[2:183]                                              |BASE (SEC):    1.0 |-(DN) |
|                                                     |PRESET:          4 |      |
|                                                     |ACCUM:           0 |      |
|                                                     +-------------------+      |
T4:81.DN - ] [ - File #5 FAULTS - 18
Rung #018
|FAULT                                                              DOOR 1   |
|DETECT                                                             CLOSED   |
|DOOR 1   DOOR 1                                                    FAULT    |
|CLOSED   CLOSED                                                    D1CLFLT  |
|D1CLTMR  DRCL1S                                                       B3    |
|  T4:81   I:006                                                             |
|----] [-----]/[-------------------------------------------------------( )---|
|     DN      00                                                       201   |
|[17]
B3/201 - ]/[ - File #5 FAULTS - 65
        -( )- - File #5 FAULTS - 18
Rung #019
|DOOR CLOSE                                           DOOR 2               |
|SOLENOID                                             CLOSE                |
|2 ENABLE                                             TIMER                |
|DRCL2                                                D2CLTMR              |
|   O:011                                             +-TON---------------+ |
|----] [----------------------------------------------|TIMER ON DELAY     |-(EN)-|
|      02                                              |TIMER:       T4:82 |      |
|[2:202]                                              |BASE (SEC):    1.0 |-(DN) |
|                                                     |PRESET:          4 |      |
|                                                     |ACCUM:           0 |      |
|                                                     +-------------------+      |
T4:82.DN - ] [ - File #5 FAULTS - 20
Rung #020
|FAULT                                                              DOOR 2   |
|DETECT                                                             CLOSED   |
|DOOR 2   DOOR 2                                                    FAULT    |
|CLOSED   CLOSED                                                    D2CLFLT  |
|D2CLTMR  DRCL2S                                                       B3    |
|  T4:82   I:006                                                             |
|----] [-----]/[-------------------------------------------------------( )---|
|     DN      02                                                       202   |
|[19]
B3/202 - ]/[ - File #5 FAULTS - 65
        -( )- - File #5 FAULTS - 20
```

```
Rung #021
|                                                                              DOOR 3                  |
|CLOSE                                                                         CLOSE                   |
|DOOR 3                                                                        TIMER                   |
|DRCL3                                                                         D3CLTMR                 |
| O:011                                                                        +-TON-----------------+ |
|-] [--------------------------------------------------------------------------+TIMER ON DELAY       +-(EN)-|
|  04                                                                          |TIMER:          T4:83| |
|[2:229]                                                                       |BASE (SEC):      1.0+-(DN) |
|                                                                              |PRESET:             4| |
|                                                                              |ACCUM:              0| |
|                                                                              +---------------------+ |
T4:83.DN - ] [ - File #5 FAULTS - 22
Rung #022
|FAULT                                                                                                 |
|DETECT                                                                                     DOOR 3     |
|DOOR 3    DOOR 3                                                                           CLOSED     |
|CLOSED    CLOSED                                                                           FAULT      |
|D3CLTMR   DRCL3S                                                                           D3CLFLT    |
| T4:83    I:006                                                                             B3        |
|--] [------]/[---------------------------------------------------------------------------------( )----|
|   DN       04                                                                              203       |
|[21]
B3/203 - ]/[ - File #5 FAULTS - 65
         -( )- - File #5 FAULTS - 22
Rung #023
|DOOR CLOSE                                                                    DOOR 4                  |
|SOLENOID                                                                      CLOSE                   |
|4 ENABLE                                                                      TIMER                   |
|DRCL4                                                                         D4CLTMR                 |
|  O:011                                                                       +-TON-----------------+ |
|---] [------------------------------------------------------------------------+TIMER ON DELAY       +-(EN)-|
|    06                                                                        |TIMER:          T4:84| |
|[2:408]                                                                       |BASE (SEC):      1.0+-(DN) |
|                                                                              |PRESET:             4| |
|                                                                              |ACCUM:              0| |
|                                                                              +---------------------+ |
T4:84.DN - ] [ - File #5 FAULTS - 24
Rung #024
|FAULT                                                                                                 |
|DETECT                                                                                     DOOR 4     |
|DOOR 4    DOOR 4                                                                           CLOSED     |
|CLOSED    CLOSED                                                                           FAULT      |
|D4CLTMR   DRCL4S                                                                           D4CLFLT    |
| T4:84    I:006                                                                             B3        |
|--] [------]/[---------------------------------------------------------------------------------( )----|
|   DN       06                                                                              204       |
|[23]
B3/204 - ]/[ - File #5 FAULTS - 65
         -( )- - File #5 FAULTS - 24
Rung #025
|DOOR CLOSE                                                                    DOOR 5                  |
|SOLENOID                                                                      CLOSE                   |
|5 ENABLE                                                                      TIMER                   |
|DRCL5                                                                         D5CLTMR                 |
|  O:031                                                                       +-TON-----------------+ |
|---] [------------------------------------------------------------------------+TIMER ON DELAY       +-(EN)-|
|    00                                                                        |TIMER:          T4:85| |
|[2:414]                                                                       |BASE (SEC):      1.0+-(DN) |
|                                                                              |PRESET:             4| |
|                                                                              |ACCUM:              0| |
|                                                                              +---------------------+ |
```

```
T4:85.DN - -| |- - File #5 FAULTS -  26
Rung #026
|FAULT                                                          DOOR 5  |
|DETECT                                                         CLOSED  |
|DOOR 5   DOOR 5                                                FAULT   |
|CLOSED   CLOSED                                                D5CLFLT |
|D5CLTMR  DRCL5S                                                  B3    |
| T4:85    I:026                                                        |
|---] [------]/[------------------------------------------------( )----|
|    DN       00                                                 205    |
|[25]
B3/205 - -|/|- - File #5 FAULTS -  65
           -( )- - File #5 FAULTS -  26
Rung #027
|DOOR CLOSE                                          DOOR 6             |
|SOLENOID                                            CLOSE              |
|6 ENABLE                                            TIMER              |
|DRCL6                                               D6CLTMR            |
|  O:031                                             +-TON-----------+  |
|---] [----------------------------------------------|TIMER ON DELAY |-(EN)-|
|    02                                              |TIMER:    T4:86|  |
|[2:420]                                             |BASE (SEC):  1.0|-(DN)|
|                                                    |PRESET:       4|  |
|                                                    |ACCUM:        0|  |
|                                                    +---------------+  |
T4:86.DN - -| |- - File #5 FAULTS -  28
Rung #028
  JLT                                                           DOOR 6  |
|DETECT                                                         CLOSED  |
|DOOR 6   DOOR 6                                                FAULT   |
|CLOSED   CLOSED                                                D6CLFLT |
|D6CLTMR  DRCL6S                                                  B3    |
| T4:86    I:026                                                        |
|---] [------]/[------------------------------------------------( )----|
|    DN       02                                                 206    |
|[27]
B3/206 - -|/|- - File #5 FAULTS -  65
           -( )- - File #5 FAULTS -  28
Rung #029
|DOOR CLOSE                                          DOOR 7             |
|SOLENOID                                            CLOSE              |
|7 ENABLE                                            TIMER              |
|DRCL7                                               D7CLTMR            |
|  O:045                                             +-TON-----------+  |
|---] [----------------------------------------------|TIMER ON DELAY |-(EN)-|
|    00                                              |TIMER:    T4:87|  |
|[2:422]                                             |BASE (SEC):  1.0|-(DN)|
|                                                    |PRESET:       4|  |
|                                                    |ACCUM:        0|  |
|                                                    +---------------+  |
T4:87.DN - -| |- - File #5 FAULTS -  30
Rung #030
|FAULT                                                          DOOR 7  |
|DETECT                                                         CLOSED  |
|DOOR 7   DOOR 7                                                FAULT   |
|CLOSED   CLOSED                                                D7CLFLT |
|D7CLTMR  DRCL7S                                                  B3    |
| T4:87    I:042                                                        |
|---] [------]/[------------------------------------------------( )----|
|    DN       00                                                 207    |
|[29]
B3/207 - -|/|- - File #5 FAULTS -  65
```

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        -( )- - File #5 FAULTS -  30
Rung #031
|DOOR CLOSE                                                          DOOR 8
|SOLENOID                                                            CLOSE
|8 ENABLE                                                            TIMER
|DRCL8                                                               D8CLTMR
|   O:045                                                            +-TON-------------+
|----| |-------------------------------------------------------------|TIMER ON DELAY   |-(EN)-
|     02                                                             |TIMER:      T4:88|
|[2:427]                                                             |BASE (SEC):   1.0|-(DN)
|                                                                    |PRESET:         4|
|                                                                    |ACCUM:          0|
|                                                                    +-----------------+
T4:88.DN - -| |- - File #5 FAULTS -  32
Rung #032
|FAULT
|DETECT                                                                     DOOR 8
|DOOR 8    DOOR 8                                                           CLOSED
|CLOSED    CLOSED                                                           FAULT
|D8CLTMR   DRCL8S                                                           D8CLFLT
|  T4:88    I:042                                                             B3
|----| |-----|/|-------------------------------------------------------------( )---
|     DN      02                                                              208
|[31]
B3/208 - -|/|- - File #5 FAULTS -  65
        -( )- - File #5 FAULTS -  32
Rung #033
  OSE
|DOOR 9                                                              DOOR 9
|SOLENOID                                                            CLOSE
|ENABLE                                                              TIMER
|DRCL9                                                               D9CLTMR
|  O:061                                                             +-TON-------------+
|----| |-------------------------------------------------------------|TIMER ON DELAY   |-(EN)-
|     00                                                             |TIMER:      T4:89|
|[2:329]                                                             |BASE (SEC):   1.0|-(DN)
|                                                                    |PRESET:         4|
|                                                                    |ACCUM:          0|
|                                                                    +-----------------+
T4:89.DN - -| |- - File #5 FAULTS -  34
Rung #034
|FAULT
|DETECT                                                                     DOOR 9
|DOOR 9    DOOR 9                                                           CLOSED
|CLOSED    CLOSED                                                           FAULT
|D9CLTMR   DRCL9S                                                           D9CLFLT
|  T4:89    I:056                                                             B3
|----| |-----|/|-------------------------------------------------------------( )---
|     DN      00                                                              209
 .33]
B3/209 - -|/|- - File #5 FAULTS -  65
        -( )- - File #5 FAULTS -  34
Rung #035
|                                                                    DOOR 10
|CLOSE DOOR                                                          CLOSE
|10 ENABLE                                                           TIMER
|DRCL10                                                              D10CLTMR
|   O:061                                                            +-TON-------------+
|----| |-------------------------------------------------------------|TIMER ON DELAY   |-(EN)-
|     02                                                             |TIMER:      T4:90|
|[2:335]                                                             |BASE (SEC):   1.0|-(DN)
|                                                                    |PRESET:         4|
|                                                                    |ACCUM:          0|
>                                                                    >>>>>>>>>>>>>>>>>>   >
```

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```
T4:90.DN - -| |- - File #5 FAULTS - 36
Rung #036
|FAULT                                                        DOOR 10
|DETECT                                                       CLOSED
|DOOR 10   DOOR 10                                            FAULT
|CLOSED    CLOSED                                             D10CLFLT
|D10CLTMR  DRCL10S                                              B3
| T4:90     I:056
|--| |------|/|---------------------------------------------------( )--|
|  DN        02                                                 210
|[35]
B3/210 - -|/|- - File #5 FAULTS - 65
         -( )- - File #5 FAULTS - 36
Rung #037
|                                                  DOOR 11
|CLOSE                                             CLOSE
|DOOR 11                                           TIMER
|DRCL11                                            D11CLTMR
| O:061                                            +-TON----------------+
|--| |---------------------------------------------+TIMER ON DELAY      +-(EN)-
|  04                                              |TIMER:        T4:91 |
|[2:337]                                           |BASE (SEC):     1.0 +-(DN)
|                                                  |PRESET:           4 |
|                                                  |ACCUM:            0 |
|                                                  +--------------------+

91.DN - -| |- - File #5 FAULTS - 38
Rung #038
|FAULT                                                        DOOR 11
|DETECT                                                       CLOSED
|DOOR 11   DOOR 11                                            FAULT
|CLOSED    CLOSED                                             D11CLFLT
|D11CLTMR  DRCL11S                                              B3
| T4:91     I:056
|--| |------|/|---------------------------------------------------( )--|
|  DN        04                                                 211
|[37]
B3/211 - -|/|- - File #5 FAULTS - 65
         -( )- - File #5 FAULTS - 38
Rung #039
|DOOR CLOSE                                        DOOR 12
|SOLENOID12                                        CLOSE
|ENABLE                                            TIMER
|DRCL12                                            D12CLTMR
| O:061                                            +-TON----------------+
|--| |---------------------------------------------+TIMER ON DELAY      +-(EN)-
|  06                                              |TIMER:        T4:92 |
|[2:353]                                           |BASE (SEC):     1.0 +-(DN)
|                                                  |PRESET:           4 |
|                                                  |ACCUM:            0 |
|                                                  +--------------------+
T4:92.DN - -| |- - File #5 FAULTS - 40
Rung #040
|FAULT                                                        DOOR 12
|DETECT    DOOR 12                                            CLOSED
|DOOR 12   CLOSED                                             FAULT
|D12CLTMR  DRCL12S                                            D12CLFLT
| T4:92     I:056                                               B3
|--| |------|/|---------------------------------------------------( )--|
|  DN        06                                                 212
|[39]
```

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B3/212 - -|/|- - File #5 FAULTS -  65
         -( )- - File #5 FAULTS -  40
Rung #041
|                                                              DOOR 1              |
|OPEN DOOR                                                     OPEN                |
|1                                                             TIMER               |
|DROP1                                                         D1OPTMR             |
|  O:011                                                       +-TON-------------+ |
|--| |---------------------------------------------------------+TIMER ON DELAY   +-(EN)-|
|   01                                                         |TIMER:    T4:101| |
|[2:181]                                                       |BASE (SEC):  1.0+-(DN) |
|                                                              |PRESET:        4| |
|                                                              |ACCUM:         0| |
|                                                              +-----------------+ |
T4:101.DN - -| |- - File #5 FAULTS -  42
Rung #042
|FAULT                                                                             |
|DETECTED                                                                 DOOR 1   |
|DOOR 1    DOOR 1                                                         OPEN     |
|OPEN      OPEN                                                           FAULT    |
|D1OPTMR   DROP1S                                                         D1OPFLT  |
| T4:101   I:006                                                            B3     |
|--| |--------|/|-------------------------------------------------------------( )----|
|   DN        01                                                            221    |
|[41]
B3/221 - -|/|- - File #5 FAULTS -  66
         -( )- - File #5 FAULTS -  42
 ng #043
|OPEN DOOR                                                     DOOR 2              |
|SOLENOID                                                      OPEN                |
|2 ENABLE                                                      TIMER               |
|DROP2                                                         D2OPTMR             |
|  O:011                                                       +-TON-------------+ |
|--| |---------------------------------------------------------+TIMER ON DELAY   +-(EN)-|
|   03                                                         |TIMER:    T4:102| |
|[2:200]                                                       |BASE (SEC):  1.0+-(DN) |
|                                                              |PRESET:        4| |
|                                                              |ACCUM:         2| |
|                                                              +-----------------+ |
T4:102.DN - -| |- - File #5 FAULTS -  44
Rung #044
|FAULT                                                                             |
|DETECT                                                                   DOOR 2   |
|DOOR 2    DOOR 2                                                         OPEN     |
|OPEN      OPEN                                                           FAULT    |
|D2OPTMR   DROP2S                                                         D2OPFLT  |
| T4:102   I:006                                                            B3     |
|--| |--------|/|-------------------------------------------------------------( )----|
    DN        03                                                            222    |
 :3]
B3/222 - -|/|- - File #5 FAULTS -  66
         -( )- - File #5 FAULTS -  44
Rung #045
|DOOR OPEN                                                     DOOR 3              |
|SOLENOID                                                      OPEN                |
|3 ENABLE                                                      TIMER               |
|DROP3                                                         D3OPTMR             |
|  O:011                                                       +-TON-------------+ |
|--| |---------------------------------------------------------+TIMER ON DELAY   +-(EN)-|
|   05                                                         |TIMER:    T4:103| |
|[2:216]                                                       |BASE (SEC):  1.0+-(DN) |
|                                                              |PRESET:        4| |
|                                                              |ACCUM:         0| |
>                                                              >>>>>>>>>>>>>>>>>>  >
```

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<                                                            <<<<<<<<<<<<<<<<<<<<<<   <
|
T4:103.DN - -| |- - File #5 FAULTS -  46
Rung #046
|FAULT                                                                    DOOR 3   |
|DETECT                                                                   OPEN     |
|DOOR 3   DOOR 3                                                          FAULT    |
|OPEN     OPEN                                                            D3OPFLT  |
|D3OPTMR  DROP3S                                                          B3       |
| T4:103   I:006                                                                   |
|--| |-----|/|---------------------------------------------------------------( )----|
|   DN       05                                                           223      |
|[45]
B3/223 - -|/|- - File #5 FAULTS -  66
         -( )- - File #5 FAULTS -  46
Rung #047
|DOOR OPEN                                                    DOOR 4              |
|SOLENOID                                                     OPEN                |
|4 ENABLE                                                     TIMER               |
|DROP4                                                        D4OPTMR             |
|  O:011                                                      +--TON----------+   |
|---| |-------------------------------------------------------|TIMER ON DELAY |-(EN)-|
|     07                                                      |TIMER:  T4:104 |   |
|[2:415]                                                      |BASE (SEC): 1.0|-(DN)|
|                                                             |PRESET:      4 |   |
|                                                             |ACCUM:       0 |   |
|                                                             +---------------+   |
  X4.DN - -| |- - File #5 FAULTS -  48
Rung #048
|FAULT                                                                    DOOR 4   |
|DETECT                                                                   OPEN     |
|DOOR 4   DOOR 4                                                          FAULT    |
|OPEN     OPEN                                                            D4OPFLT  |
|D4OPTMR  DROP4S                                                          B3       |
| T4:104   I:006                                                                   |
|--| |-----|/|---------------------------------------------------------------( )----|
|   DN       07                                                           224      |
|[47]
B3/224 - -|/|- - File #5 FAULTS -  66
         -( )- - File #5 FAULTS -  48
Rung #049
|DOOR OPEN                                                    DOOR 5              |
|SOLENOID                                                     OPEN                |
|5 ENABLE                                                     TIMER               |
|DROP5                                                        D5OPTMR             |
|  O:031                                                      +--TON----------+   |
|---| |-------------------------------------------------------|TIMER ON DELAY |-(EN)-|
|     01                                                      |TIMER:  T4:105 |   |
|[2:46]                                                       |BASE (SEC): 1.0|-(DN)|
|                                                             |PRESET:      4 |   |
|                                                             |ACCUM:       0 |   |
|                                                             +---------------+   |
T4:105.DN - -| |- - File #5 FAULTS -  50
Rung #050
|FAULT                                                                    DOOR 5   |
|DETECT                                                                   OPEN     |
|DOOR 5   DOOR 5                                                          FAULT    |
|OPEN     OPEN                                                            D5OPFLT  |
|D5OPTMR  DROP5S                                                          B3       |
| T4:105   I:026                                                                   |
|--| |-----|/|---------------------------------------------------------------( )----|
|   DN       01                                                           225      |
|[49]
```

```
B3/225 - -|/|- - File #5 FAULTS -  66
         -( )- - File #5 FAULTS -  50
Rung #051
|DOOR OPEN                                                    DOOR 6           |
|SOLENOID                                                     OPEN             |
|6 ENABLE                                                     TIMER            |
|DROP6                                                        D6OPTMR          |
|  O:031                                                      +-TON---------+  |
|---] [-------------------------------------------------------|TIMER ON DELAY|-(EN)-|
|   03                                                        |TIMER:  T4:106|  |
|[2:47]                                                       |BASE (SEC): 1.0|-(DN) |
|                                                             |PRESET:      4|  |
|                                                             |ACCUM:       0|  |
|                                                             +--------------+  |
T4:106.DN - -] [- - File #5 FAULTS -  52
Rung #052
|FAULT                                                                        |
|DETECT                                                             DOOR 6    |
|DOOR 6    DOOR 6                                                   OPEN      |
|OPEN      OPEN                                                     FAULT     |
|D6OPTMR   DROP6S                                                   D6OPFLT   |
| T4:106   I:026                                                      B3      |
|---] [------]/[----------------------------------------------------( )-------|
|   DN       03                                                      226      |
|[51]                                                                         |
B3/226 - -|/|- - File #5 FAULTS -  66
         -( )- - File #5 FAULTS -  52
 .ng #053
|DOOR OPEN                                                    DOOR 7           |
|SOLENOID                                                     OPEN             |
|7 ENABLE                                                     TIMER            |
|DROP7                                                        D7OPTMR          |
|  O:045                                                      +-TON---------+  |
|---] [-------------------------------------------------------|TIMER ON DELAY|-(EN)-|
|   01                                                        |TIMER:  T4:107|  |
|[2:48]                                                       |BASE (SEC): 1.0|-(DN) |
|                                                             |PRESET:      4|  |
|                                                             |ACCUM:       0|  |
|                                                             +--------------+  |
T4:107.DN - -] [- - File #5 FAULTS -  54
Rung #054
|FAULT                                                                        |
|DETECT                                                             DOOR 7    |
|DOOR 7    DOOR 7                                                   OPEN      |
|OPEN      OPEN                                                     FAULT     |
|D7OPTMR   DROP7S                                                   D7OPFLT   |
| T4:107   I:042                                                      B3      |
|---] [------]/[----------------------------------------------------( )-------|
    DN       01                                                      227      |
 .53]                                                                         |
B3/227 - -|/|- - File #5 FAULTS -  66
         -( )- - File #5 FAULTS -  54
Rung #055
|DOOR OPEN                                                    DOOR 8           |
|SOLENOID                                                     OPEN             |
|8 ENABLE                                                     TIMER            |
|DROP8                                                        D8OPTMR          |
|  O:045                                                      +-TON---------+  |
|---] [-------------------------------------------------------|TIMER ON DELAY|-(EN)-|
|   03                                                        |TIMER:  T4:108|  |
|[2:49]                                                       |BASE (SEC): 1.0|-(DN) |
|                                                             |PRESET:      4|  |
|                                                             |ACCUM:       0|  |
>                                                             >>>>>>>>>>>>>>>>>>  >
```

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                                                              <<<<<<<<<<<<<<<<<<<    <
T4:108.DN - -| |- - File #5 FAULTS - 56
Rung #056
|FAULT
|DETECT                                                              DOOR 8    |
|DOOR 8   DOOR 8                                                     OPEN      |
|OPEN     OPEN                                                       FAULT     |
|D8OPTMR  DROP8S                                                     D8OPFLT   |
| T4:108   I:042                                                      B3       |
|---| |-----|/|-----------------------------------------------------------( )---|
|    DN      03                                                       228      |
|[55]
B3/228 - -|/|- - File #5 FAULTS - 66
         -( )- - File #5 FAULTS - 56
Rung #057
|DOOR OPEN                                                DOOR 9               |
|SOLENOID                                                 OPEN                 |
|9 ENABLE                                                 TIMER                |
|DROP9                                                    D9OPTMR              |
|  O:061                                                  +-TON------------+   |
|---| |-------------------------------------------------- -|TIMER ON DELAY  |-(EN)-|
|    01                                                   |TIMER:    T4:109|   |
|[2:325]                                                  |BASE (SEC):  1.0|-(DN) |
|                                                         |PRESET:        4|   |
|                                                         |ACCUM:         0|   |
|                                                         +----------------+   |
  109.DN - -| |- - File #5 FAULTS - 58
Rung #058
|FAULT
|DETECT                                                              DOOR 9    |
|DOOR 9   DOOR 9                                                     OPEN      |
|OPEN     OPEN                                                       FAULT     |
|D9OPTMR  DROP9S                                                     D9OPFLT   |
| T4:109   I:056                                                      B3       |
|---| |-----|/|-----------------------------------------------------------( )---|
|    DN      01                                                       229      |
|[57]
B3/229 - -|/|- - File #5 FAULTS - 66
         -( )- - File #5 FAULTS - 58
Rung #059
|DOOR OPEN                                                DOOR 10              |
|SOLENOID                                                 OPEN                 |
|10 ENABLE                                                TIMER                |
|DROP10                                                   D10OPTMR             |
|  O:061                                                  +-TON------------+   |
|---| |---------------------------------------------------|TIMER ON DELAY  |-(EN)-|
|    03                                                   |TIMER:    T4:110|   |
|[2:326]                                                  |BASE (SEC):  1.0|-(DN) |
|                                                         |PRESET:        4|   |
|                                                         |ACCUM:         0|   |
|                                                         +----------------+   |
T4:110.DN - -| |- - File #5 FAULTS - 60
Rung #060
|FAULT
|DETECT                                                              DOOR 10   |
|DOOR 10  DOOR 10                                                    OPEN      |
|OPEN     OPEN                                                       FAULT     |
|D10OPTMR DROP10S                                                    D10OPFLT  |
| T4:110   I:056                                                      B3       |
|---| |-----|/|-----------------------------------------------------------( )---|
|    DN      03                                                       230      |
|[59]
```

615

```
B3/230 - -|/|- - File #5 FAULTS -  66
         -( )- - File #5 FAULTS -  60
Rung #061
|DOOR OPEN                                                      DOOR 11         |
|SOLENOID                                                       OPEN            |
|11 ENABLE                                                      TIMER           |
|DROP11                                                         D11OPTMR        |
|   O:061                                                       +-TON----------+|
|---] [-----------------------------------------------------------+TIMER ON DELAY +-(EN)-|
|    05                                                         |TIMER:   T4:111||
|[2:327]                                                        |BASE (SEC): 1.0+-(DN) |
|                                                               |PRESET:      4||
|                                                               |ACCUM:       0||
|                                                               +--------------+|
T4:111.DN - -] [- - File #5 FAULTS -  62
Rung #062
|FAULT                                                                          |
|DETECT                                                              DOOR 11    |
|DOOR 11   DOOR 11                                                   OPEN       |
|OPEN      OPEN                                                      FAULT      |
|D11OPTMR  DROP11S                                                   D11OPFLT   |
|  T4:111    I:056                                                     B3       |
|---] [-------]/[---------------------------------------------------------( )---|
|   DN        05                                                       231      |
|[61]                                                                           |
B3/231 - -|/|- - File #5 FAULTS -  66
         -( )- - File #5 FAULTS -  62
  ng #063
|DOOR OPEN                                                      DOOR 12         |
|SOLENOID                                                       OPEN            |
|12 ENABLE                                                      TIMER           |
|DROP12                                                         D12OPTMR        |
|   O:061                                                       +-TON----------+|
|---] [-----------------------------------------------------------+TIMER ON DELAY +-(EN)-|
|    07                                                         |TIMER:   T4:112||
|[2:351]                                                        |BASE (SEC): 1.0+-(DN) |
|                                                               |PRESET:      4||
|                                                               |ACCUM:       0||
|                                                               +--------------+|
T4:112.DN - -] [- - File #5 FAULTS -  64
Rung #064
|FAULT                                                                          |
|DETECT                                                              DOOR 12    |
|DOOR 12   DOOR 12                                                   OPEN       |
|OPEN      OPEN                                                      FAULT      |
|D12OPTMR  DROP12S                                                   D12OPFLT   |
|  T4:112    I:056                                                     B3       |
|---] [-------]/[---------------------------------------------------------( )---|
    DN        07                                                       232      |
 53]                                                                            |
B3/232 - -|/|- - File #5 FAULTS -  66
         -( )- - File #5 FAULTS -  64
Rung #065
|DOOR 1   DOOR 2   DOOR 3   DOOR 4   DOOR 5   DOOR 6   DOOR 7   DOOR 8   DOOR 9   DOOR 10  DOOR 11  DOOR 12     DOOR      |
|CLOSED   CLOSED   CLOSED   CLOSED   CLOSED   CLOSED   CLOSED   CLOSED   CLOSED   CLOSED   CLOSED   CLOSED      CLOSED    |
|FAULT    FAULT    FAULT    FAULT    FAULT    FAULT    FAULT    FAULT    FAULT    FAULT    FAULT    FAULT       NO FAULT  |
|D1CLFLT  D2CLFLT  D3CLFLT  D4CLFLT  D5CLFLT  D6CLFLT  D7CLFLT  D8CLFLT  D9CLFLT  D10CLFLT D11CLFLT D12CLFLT    DRCLNOFLT |
|  B3       B3       B3       B3       B3       B3       B3       B3       B3       B3       B3       B3          B3      |
|---]/[----]/[----]/[----]/[----]/[----]/[----]/[----]/[----]/[----]/[----]/[----]/[-------------( )---|
|  201      202      203      204      205      206      207      208      209      210      211      212         213      |
|[18]     [20]     [22]     [24]     [26]     [28]     [30]     [32]     [34]     [36]     [38]     [40]                  |
B3/213 - -|/|- - File #5 FAULTS -  67
```

616

```
   -( )- - File #5 FAULTS -  65
Rung #066
|DOOR 1   DOOR 2   DOOR 3   DOOR 4   DOOR 5   DOOR 6   DOOR 7   DOOR 8   DOOR 9   DOOR 10   DOOR 11   DOOR 12          DOOR       |
|OPEN     OPEN     OPEN     OPEN     OPEN     OPEN     OPEN     OPEN     OPEN     OPEN      OPEN      OPEN             OPEN       |
|FAULT    FAULT    FAULT    FAULT    FAULT    FAULT    FAULT    FAULT    FAULT    FAULT     FAULT     FAULT            NO FAULT   |
|D1OPFLT  D2OPFLT  D3OPFLT  D4OPFLT  D5OPFLT  D6OPFLT  D7OPFLT  D8OPFLT  D9OPFLT  D10OPFLT  D11OPFLT  D12OPFLT         DROPNOFLT  |
|  B3       B3       B3       B3       B3       B3       B3       B3       B3       B3        B3        B3               B3       |
|--]/[-----]/[-----]/[-----]/[-----]/[-----]/[-----]/[-----]/[-----]/[-----]/[------]/[------]/[--------------------( )----|
|  221      222      223      224      225      226      227      228      229      230       231       232              214      |
|[42]     [44]     [46]     [48]     [50]     [52]     [54]     [56]     [58]     [60]      [62]      [64]
B3/214 - ]/[ - File #5 FAULTS -  67
       -( )- - File #5 FAULTS -  66
Rung #067
| DOOR                                                                                                                        |
| CLOSED                                                                                                      DOOR FAULT      |
| NO FAULT                                                                                                    DRFLT           |
| DRCLNOFLT                                                                                                     B3            |
|    B3                                                                                                                       |
|-+---]/[---+---------------------------------------------------------------------------------------------------(L)-----------|
| |   213   |                                                                                                   215           |
| |[65]     |                                                                                                                 |
| |         | B3/215 - ] [ - File #2 MAIN_PRGRM - 625                                                                         |
| |         |          ]/[ - File #2 MAIN_PRGRM - 158                                                                         |
| |         |          -(U)- - File #5 FAULTS - 68                                                                            |
| |         |                                                                                                                 |
| |DOOR     |                                                                                                                 |
| |OPEN     |                                                                                                                 |
| |NO FAULT |                                                                                                                 |
|  DROPNOFLT|                                                                                                                 |
| |   B3    |                                                                                                                 |
| +---]/[---+                                                                                                                 |
|     214                                                                                                                     |
| [66]
Rung #068
|PAUSE                                                                                                        DOOR FAULT      |
|DISABLE                                                                                                      DRFLT           |
|TS12                                                                                                           B3            |
| N7:16                                                                                                                       |
|--] [----------------------------------------------------------------------------------------------------------(U)-----------|
|   4                                                                                                           215           |
|[2:3]
B3/215 - ] [ - File #2 MAIN_PRGRM -  625
         ]/[ - File #2 MAIN_PRGRM -  158
         -(L)- - File #5 FAULTS -  67
         -(U)- - File #5 FAULTS -  68
Rung #069                                                                                          CRYO VALVE                 |
|CRYO GATE                                                                                         1 OPEN                     |
|HEATER 1                                                                                          TIMER                      |
|CHAMBER                                                                                           CV1OPTMR                   |
|HV1                                                                                               +-TON-----------------+    |
| O:011                                                                                            |TIMER ON DELAY       |-(EN)-|
|--] [---------------------------------------------------------------------------------------------|TIMER:          T4:49|      |
|   11                                                                                             |BASE (SEC):       1.0|-(DN) |
|[2:115]                                                                                           |PRESET:             7|      |
|                                                                                                  |ACCUM:              7|      |
|                                                                                                  +---------------------+      |
T4:49.DN - ] [ - File #5 FAULTS -  70
```

617

```
Rung #070
|FAULT        HEATER 1                                                        CRYO VALVE  |
|DETECT       CHAMBER                                                         1 OPEN      |
|CRYO VALVE   GATE VALVE                                                      FAULT       |
|1 OPEN       OPEN                                                            CV1OPFLT    |
|CV1OPTMR     HV1S3                                                              B3       |
|  T4:49        I:002                                                                     |
|---] [---------]/[-----------------------------------------------------------( )--------|
|     DN         10                                                              251      |
|[69]
B3/251 - ]/[ - File #5 FAULTS -  93
         ( ) - File #5 FAULTS -  70
Rung #071
|CRYO GATE    CRYO GATE                                                                   |
|SOLENOID 1   SOLENOID 2                                            CRYO VALVE            |
|HEATER 2     HEATER 2                                              2 OPEN                |
|CHAMBER      CHAMBER                                               TIMER                 |
|HV2_1        HV2_2                                                 CV2OPTMR              |
|  O:011        O:011                                               +--TON--------------+ |
|---] [---------] [-------------------------------------------------|TIMER ON DELAY     |-(EN)-|
|    13           14                                                |TIMER:       T4:50 |      |
|[2:117]      [2:118]                                               |BASE (SEC):    1.0 |-(DN) |
|                                                                   |PRESET:          5 |      |
|                                                                   |ACCUM:           0 |      |
|                                                                   +-------------------+      |
T4:50.DN - ] [ - File #5 FAULTS -  72
Rung #072
  ILT         HEATER 2                                                        CRYO VALVE  |
|DETECT       CHAMBER                                                         2 OPEN      |
|CRYO VALVE   GATE VALVE                                                      FAULT       |
|2 OPEN       OPEN                                                            CV2OPFLT    |
|CV2OPTMR     HV2S3                                                              B3       |
|  T4:50        I:004                                                                     |
|---] [---------]/[-----------------------------------------------------------( )--------|
|     DN         02                                                              252      |
|[71]
B3/252 - ]/[ - File #5 FAULTS -  93
         ( ) - File #5 FAULTS -  72
Rung #073
|CRYO GATE    CRYO GATE                                                                   |
|SOLENOID 1   SOLENOID 2                                            CRYO VALVE            |
|DWELL 1      DWELL 1                                               3 OPEN                |
|CHAMBER      CHAMBER                                               TIMER                 |
|HV3_1        HV3_2                                                 CV3OPTMR              |
|  O:011        O:011                                               +--TON--------------+ |
|---] [---------] [-------------------------------------------------|TIMER ON DELAY     |-(EN)-|
|    15           16                                                |TIMER:       T4:51 |      |
|[2:119]      [2:120]                                               |BASE (SEC):    1.0 |-(DN) |
|                                                                   |PRESET:          5 |      |
|                                                                   |ACCUM:           0 |      |
|                                                                   +-------------------+      |
T4:51.DN - ] [ - File #5 FAULTS -  74
Rung #074
|FAULT        DWELL 1                                                         CRYO VALVE  |
|DETECT       CHAMBER                                                         3 OPEN      |
|CRYO VALVE   GATE VALVE                                                      FAULT       |
|3 OPEN       OPEN                                                            CV3OPFLT    |
|CV3OPTMR     HV3S3                                                              B3       |
|  T4:51        I:004                                                                     |
|---] [---------]/[-----------------------------------------------------------( )--------|
|     DN         05                                                              253      |
|[73]
```

```
B3/253 - -|/|- - File #5 FAULTS -  93
        -( )- - File #5 FAULTS -  74
Rung #075
|CRYO GATE    CRYO GATE                                          CRYO VALVE
|SOLENOID 1   SOLENOID 2                                         4 OPEN
|DWELL 2      DWELL 2                                            TIMER
|CHAMBER      CHAMBER                                            CV4OPTMR
|HV4_1        HV4_2                                              +-TON----------------+
|  0:031        0:031                                            |TIMER ON DELAY      |-(EN)-
|--| |----------| |----------------------------------------------|TIMER:       T4:52 |
|   11          12                                               |BASE (SEC):   1.0  |-(DN)
|[2:121]     [2:122]                                             |PRESET:         5  |
|                                                                |ACCUM:          0  |
|                                                                +--------------------+
T4:52.DN - -| |- - File #5 FAULTS -  76
Rung #076
|FAULT        DWELL 2                                                 CRYO VALVE
|DETECT       CHAMBER                                                 4 OPEN
|CRYO VALVE   GATE VALVE                                              FAULT
|4 OPEN       OPEN                                                    CV4OPFLT
|CV4OPTMR     HV4S3                                                      B3
|  T4:52        I:022
|--| |----------|/|----------------------------------------------------( )---
|   DN          10                                                      254
|[75]
B3/254 - -|/|- - File #5 FAULTS -  93
        -( )- - File #5 FAULTS -  76
..ung #077
|CRYO GATE    CRYO GATE                                          CRYO VALVE
|SOLENOID 1   SOLENOID 2                                         5 OPEN
|HEATER 2     HEATER 2                                           TIMER
|CHAMBER      CHAMBER                                            CV5OPTMR
|HV5_1        HV5_2                                              +-TON----------------+
|  0:031        0:031                                            |TIMER ON DELAY      |-(EN)-
|--| |----------| |----------------------------------------------|TIMER:       T4:53 |
|   13          14                                               |BASE (SEC):   1.0  |-(DN)
|[2:123]     [2:124]                                             |PRESET:         5  |
|                                                                |ACCUM:          0  |
|                                                                +--------------------+
T4:53.DN - -| |- - File #5 FAULTS -  78
Rung #078
|FAULT        HEATER 3                                                CRYO VALVE
|DETECT       CHAMBER                                                 5 OPEN
|CRYO VALVE   GATE VALVE                                              FAULT
|5 OPEN       OPEN                                                    CV5OPFLT
|CV5OPTMR     HV5S3                                                      B3
|  T4:53        I:024
|--| |----------|/|----------------------------------------------------( )---
|   DN          02                                                      255
|[77]
B3/255 - -|/|- - File #5 FAULTS -  93
        -( )- - File #5 FAULTS -  78
```

619

Rung #079

```
|CRYO GATE   CRYO GATE                                                                          |
|SOLENOID 1  SOLENOID 2                                                         CRYO VALVE      |
|DWELL 3     DWELL 3                                                            6 OPEN          |
|CHAMBER     CHAMBER                                                            TIMER           |
|HV6_1       HV6_2                                                              CV6OPTMR        |
|  O:031       O:031                                                            +-TON---------+ |
|---] [--------] [--------------------------------------------------------------|TIMER ON DELAY|-(EN)-|
|    15          16                                                             |TIMER:   T4:54| |
| [2:125]     [2:126]                                                           |BASE (SEC): 1.0|-(DN) |
|                                                                               |PRESET:      5| |
|                                                                               |ACCUM:       0| |
|                                                                               +--------------+ |
T4:54.DN - ] [ - File #5 FAULTS -  80
```

Rung #080

```
|FAULT       DWELL 3                                                                  |
|DETECT      CHAMBER                                                      CRYO VALVE  |
|CRYO VALVE  GATE VALVE                                                   6 OPEN      |
|6 OPEN      OPEN                                                         FAULT       |
|CV6OPTMR    HV6S3                                                        CV6OPFLT    |
|  T4:54       I:024                                                         B3       |
|---] [--------]/[-------------------------------------------------------------( )----|
|    DN          05                                                           256     |
|[79]                                                                                 |
B3/256 - ]/[ - File #5 FAULTS -  93
       -( )- - File #5 FAULTS -  80
```

Rung #081

```
 'YO GATE    CRYO GATE                                                                          |
|SOLENOID 1  SOLENOID 2                                                         CRYO VALVE      |
|DWELL 4     DWELL 4                                                            7 OPEN          |
|CHAMBER     CHAMBER                                                            TIMER           |
|HV7_1       HV7_2                                                              CV7OPTMR        |
|  O:045       O:045                                                            +-TON---------+ |
|---] [--------] [--------------------------------------------------------------|TIMER ON DELAY|-(EN)-|
|    11          12                                                             |TIMER:   T4:55| |
| [2:127]     [2:128]                                                           |BASE (SEC): 1.0|-(DN) |
|                                                                               |PRESET:      5| |
|                                                                               |ACCUM:       0| |
|                                                                               +--------------+ |
T4:55.DN - ] [ - File #5 FAULTS -  82
```

Rung #082

```
|FAULT       DWELL 4                                                                  |
|DETECT      CHAMBER                                                      CRYO VALVE  |
|CRYO VALVE  GATE VALVE                                                   7 OPEN      |
|7 OPEN      OPEN                                                         FAULT       |
|CV7OPTMR    HV7S3                                                        CV7OPFLT    |
|  T4:55       I:036                                                         B3       |
|---] [--------]/[-------------------------------------------------------------( )----|
|    DN          10                                                           257     |
 [81]                                                                                 |
B3/257 - ]/[ - File #5 FAULTS -  93
       -( )- - File #5 FAULTS -  82
```

620

```
Rung #083
|CRYO GATE    CRYO GATE                                                      CRYO VALVE                     |
|SOLENOID 1   SOLENOID 2                                                     8 OPEN                         |
|BUFFER 3     BUFFER 3                                                       TIMER                          |
|CHAMBER      CHAMBER                                                        CV8OPTMR                       |
|HV8_1        HV8_2                                                          +-TON------------+             |
|  O:045        O:045                                                        |TIMER ON DELAY  |-(EN)-|
|---] [---------] [----------------------------------------------------------|TIMER:     T4:56|      |
|    13           14                                                         |BASE (SEC):  1.0|-(DN)  |
|[2:129]       [2:130]                                                       |PRESET:        5|       |
|                                                                            |ACCUM:         0|       |
|                                                                            +----------------+       |
T4:56.DN - ] [ - File #5 FAULTS -  84
Rung #084
|FAULT        BUFFER 3                                                              CRYO VALVE |
|DETECT       CHAMBER                                                               8 OPEN     |
|CRYO VALVE   GATE VALVE                                                            FAULT      |
|8 OPEN       OPEN                                                                  CV8OPFLT   |
|CV8OPTMR     HV8S3                                                                    B3      |
|  T4:56        I:040                                                                          |
|---] [---------]/[--------------------------------------------------------------------( )-----|
|    DN           02                                                                   258     |
|[83]
B3/258 - ]/[ - File #5 FAULTS -  93
         -( )- - File #5 FAULTS -  84
Rung #085
   YO GATE    CRYO GATE                                                      CRYO VALVE                     |
|SOLENOID 1   SOLENOID 2                                                     9 OPEN                         |
|DWELL 5      DWELL 5                                                        TIMER                          |
|CHAMBER      CHAMBER                                                        CV9OPTMR                       |
|HV9_1        HV9_2                                                          +-TON------------+             |
|  O:045        O:045                                                        |TIMER ON DELAY  |-(EN)-|
|---] [---------] [----------------------------------------------------------|TIMER:     T4:57|      |
|    15           16                                                         |BASE (SEC):  1.0|-(DN) |
|[2:131]       [2:132]                                                       |PRESET:        5|      |
|                                                                            |ACCUM:         0|      |
|                                                                            +----------------+      |
T4:57.DN - ] [ - File #5 FAULTS -  86
Rung #086
|FAULT        DWELL 5                                                               CRYO VALVE |
|DETECT       CHAMBER                                                               9 OPEN     |
|CRYO VALVE   GATE VALVE                                                            FAULT      |
|9 OPEN       OPEN                                                                  CV9OPFLT   |
|CV9OPTMR     HV9S3                                                                    B3      |
|  T4:57        I:040                                                                          |
|---] [---------]/[--------------------------------------------------------------------( )-----|
|    DN           05                                                                   259     |
 [85]
B3/259 - ]/[ - File #5 FAULTS -  93
         -( )- - File #5 FAULTS -  86
```

```
Rung #087
|CRYO GATE   CRYO GATE                                                              |
|SOLENOID 1  SOLENOID 2                                               CRYO VALVE    |
|DWELL 6     DWELL 6                                                  10 OPEN       |
|CHAMBER     CHAMBER                                                  TIMER         |
|HV10_1      HV10_2                                                   CV10OPTRM     |
|  O:061       O:061                                                 +--TON--------+ |
|---] [-------] [----------------------------------------------------+TIMER ON DELAY+-(EN)-|
|    11          12                                                  |TIMER:  T4:58|       |
|[2:133]     [2:134]                                                 |BASE (SEC): 1.0+-(DN) |
|                                                                    |PRESET:      5|       |
|                                                                    |ACCUM:       0|       |
|                                                                    +--------------+       |
T4:58.DN - ] [ - File #5 FAULTS - 88
Rung #088
|FAULT       DWELL 6                                                                |
|DETEC       CHAMBER                                                  CRYO VALVE    |
|CRYO VALVE  GATE VALVE                                               10 OPEN       |
|10 OPEN     OPEN                                                     FAULT         |
|CV10OPTRM   HV10S3                                                   CV10OPFLT     |
|  T4:58       I:052                                                     B3         |
|---] [-------]/[-------------------------------------------------------( )--------|
|    DN          10                                                      260        |
|[87]
B3/260 - ]/[ - File #5 FAULTS - 93
       -( )- - File #5 FAULTS - 88
Rung #089
   YO GATE   CRYO GATE                                                              |
|SOLENOID 1  SOLENOID 2                                               CRYO VALVE    |
|BUFFER 4    BUFFER 4                                                 11 OPEN       |
|CHAMBER     CHAMBER                                                  TIMER         |
|HV11_1      HV11_2                                                   CV11OPTMR     |
|  O:061       O:061                                                 +--TON--------+ |
|---] [-------] [----------------------------------------------------+TIMER ON DELAY+-(EN)-|
|    13          14                                                  |TIMER:  T4:59|       |
|[2:135]     [2:136]                                                 |BASE (SEC): 1.0+-(DN) |
|                                                                    |PRESET:      5|       |
|                                                                    |ACCUM:       0|       |
|                                                                    +--------------+       |
T4:59.DN - ] [ - File #5 FAULTS - 90
Rung #090
|FAULT       BUFFER 4                                                               |
|DETECT      CHAMBER                                                  CRYO VALVE    |
|CRYO VALVE  GATE VALVE                                               11 OPEN       |
|11 OPEN     OPEN                                                     FAULT         |
|CV11OPTMR   HV11S3                                                   CV11OPFLT     |
|  T4:59       I:054                                                     B3         |
|---] [-------]/[-------------------------------------------------------( )--------|
|    DN          02                                                      261        |
 [89]
B3/261 - ]/[ - File #5 FAULTS - 93
       -( )- - File #5 FAULTS - 90
```

622

Rung #091
|CRYO GATE SOLENOID 1 EXBUFFER CHAMBER HV12_1 0:061 —] [— 15 [2:137]
CRYO GATE SOLENOID 2 EXBUFFER CHAMBER HV12_2 0:061 —] [— 16 [2:138]
CRYO VALVE 12 OPEN TIMER CV12OPTMR
TON: TIMER ON DELAY —(EN)— TIMER: T4:60 BASE (SEC): 1.0 —(DN) PRESET: 5 ACCUM: 0

T4:60.DN - —] [— - File #5 FAULTS - 92

Rung #092
|FAULT DETECT CRYO VALVE 12 OPEN CV12OPTMR T4:60 —] [— DN [91]
EXIT BUFFER GATE VALVE OPEN HV12S3 I:054 —]/[— 05
CRYO VALVE 12 OPEN FAULT CV12OPFLT B3 —( )— 262

B3/262 - —]/[— - File #5 FAULTS - 93
—( )— - File #5 FAULTS - 92

Rung #093
CRYO VALVE 1 OPEN FAULT CV1OPFLT B3 —]/[— 251 [70]
CRYO VALVE 2 OPEN FAULT CV2OPFLT B3 —]/[— 252 [72]
CRYO VALVE 3 OPEN FAULT CV3OPFLT B3 —]/[— 253 [74]
CRYO VALVE 4 OPEN FAULT CV4OPFLT B3 —]/[— 254 [76]
CRYO VALVE 5 OPEN FAULT CV5OPFLT B3 —]/[— 255 [78]
CRYO VALVE 6 OPEN FAULT CV6OPFLT B3 —]/[— 256 [80]
CRYO VALVE 7 OPEN FAULT CV7OPFLT B3 —]/[— 257 [82]
CRYO VALVE 8 OPEN FAULT CV8OPFLT B3 —]/[— 258 [84]
CRYO VALVE 9 OPEN FAULT CV9OPFLT B3 —]/[— 259 [86]
CRYO VALVE 10 OPEN FAULT CV10OPFLT B3 —]/[— 260 [88]
CRYO VALVE 11 OPEN FAULT CV11OPFLT B3 —]/[— 261 [90]
CRYO VALVE 12 OPEN FAULT CV12OPFLT B3 —]/[— 262 [92]
CRYO VALVE OPEN FAULT CVOPFLT B3 —( )— 312

B3/312 - —]/[— - File #5 FAULTS - 142
—( )— - File #5 FAULTS - 93

Rung #094
|CRYO GATE SOLENOID 1 HEATER 2 CHAMBER HV2_1 0:011 —]/[— 13 [2:117]
CRYO GATE SOLENOID 2 HEATER 2 CHAMBER HV2_2 0:011 —] [— 14 [2:118]
CRYO VALVE 2 THROTTLE TIMER CV2THTMR
TON: TIMER ON DELAY —(EN)— TIMER: T4:114 BASE (SEC): 1.0 —(DN) PRESET: 5 ACCUM: 5

T4:114.DN - —] [— - File #5 FAULTS - 95

Rung #095
```
|FAULT       HEATER 2                                               |
|DETECT      CHAMBER                                   CRYO VALVE   |
|CRYO VALVE  GATE VALVE                                2 THROTTLE   |
|2 THROTTLE  THROTTLED                                 FAULT        |
|CV2THTMR    HV2S2                                     CV2THFLT     |
|  T4:114     I:004                                       B3        |
|---] [--------]/[--------------------------------------( )---------|
|    DN        01                                        234        |
|[94]                                                               |
B3/234 - ]/[ - File #5 FAULTS - 116
       -( )- - File #5 FAULTS - 95
```

Rung #096
```
|CRYO GATE   CRYO GATE                                              |
|SOLENOID 1  SOLENOID 2                       CRYO VALVE            |
|DWELL 1     DWELL 1                          3 THROTTLE            |
|CHAMBER     CHAMBER                          TIMER                 |
|HV3_1       HV3_2                            CV3THTMR              |
|  O:011      O:011                           +-TON----------------+|
|---]/[--------] [----------------------------|TIMER ON DELAY      |-(EN)-|
|    15        16                             |TIMER:       T4:115 ||
|[2:119]     [2:120]                          |BASE (SEC):     1.0 |-(DN)|
|                                             |PRESET:           5 ||
|                                             |ACCUM:            5 ||
|                                             +--------------------+|
T4:115.DN - ] [ - File #5 FAULTS - 97
```

Rung #097
```
|FAULT       DWELL 1                                                |
|DETECT      CHAMBER                                   CRYO VALVE   |
|CRYO VALVE  GATE VALVE                                3 THROTTLE   |
|3 THROTTLE  THROTTLED                                 FAULT        |
|CV3THTMR    HV3S2                                     CV3THFLT     |
|  T4:115     I:004                                       B3        |
|---] [--------]/[--------------------------------------( )---------|
|    DN        04                                        235        |
|[96]                                                               |
B3/235 - ]/[ - File #5 FAULTS - 116
       -( )- - File #5 FAULTS - 97
```

Rung #098
```
|CRYO GATE   CRYO GATE                                              |
|SOLENOID 1  SOLENOID 2                       CRYO VALVE            |
|DWELL 2     DWELL 2                          4 THROTTLE            |
|CHAMBER     CHAMBER                          TIMER                 |
|HV4_1       HV4_2                            CV4THTMR              |
|  O:031      O:031                           +-TON----------------+|
|---]/[--------] [----------------------------|TIMER ON DELAY      |-(EN)-|
|    11        12                             |TIMER:       T4:116 ||
|[2:121]     [2:122]                          |BASE (SEC):     1.0 |-(DN)|
|                                             |PRESET:           5 ||
|                                             |ACCUM:            5 ||
|                                             +--------------------+|
T4:116.DN - ] [ - File #5 FAULTS - 99
```

Rung #099
```
|FAULT       DWELL 2                                                |
|DETECT      CHAMBER                                   CRYO VALVE   |
|CRYO VALVE  GATE VALVE                                4 THROTTLE   |
|4 THROTTLE  THROTTLED                                 FAULT        |
|CV4THTMR    HV4S2                                     CV4THFLT     |
|  T4:116     I:022                                       B3        |
|---] [--------]/[--------------------------------------( )---------|
|    DN        07                                        236        |
|[98]                                                               |
```

```
B3/236 - -|/|- - File #5 FAULTS -  116
         -( )- - File #5 FAULTS -  99
Rung #100
|CRYO GATE   CRYO GATE
|SOLENOID 1  SOLENOID 2                                                  CRYO VALVE
|HEATER 2    HEATER 2                                                    5 THROTTLE
|CHAMBER     CHAMBER                                                     TIMER
|HV5_1       HV5_2                                                       CVSTHTMR
|  O:031       O:031                                                    +-TON-----------+
|---|/|-------| |-------------------------------------------------------|TIMER ON DELAY |-(EN)-
|    13        14                                                       |TIMER:   T4:117|
|[2:123]     [2:124]                                                    |BASE (SEC): 1.0|-(DN)
|                                                                       |PRESET:       5|
|                                                                       |ACCUM:        5|
|                                                                       +---------------+
T4:117.DN - -| |- - File #5 FAULTS -  101
Rung #101
|FAULT        HEATER 3
|DETECT       CHAMBER                                                          CRYO VALVE
|CRYO VALVE   GATE VALVE                                                       5 THROTTLE
|5 THROTTLE   THROTTLED                                                        FAULT
|CVSTHTMR     HV5S2                                                            CVSTHFLT
|  T4:117       I:024                                                             B3
|---| |---------|/|-----------------------------------------------------------( )---
|    DN          01                                                               237
|[100]
B3/237 - -|/|- - File #5 FAULTS -  116
         -( )- - File #5 FAULTS -  101
 ung #102
|CRYO GATE   CRYO GATE
|SOLENOID 1  SOLENOID 2                                                  CRYO VALVE
|DWELL 3     DWELL 3                                                     6 THROTTLE
|CHAMBER     CHAMBER                                                     TIMER
|HV6_1       HV6_2                                                       CV6THTMR
|  O:031       O:031                                                    +-TON-----------+
|---|/|-------| |-------------------------------------------------------|TIMER ON DELAY |-(EN)-
|    15        16                                                       |TIMER:   T4:118|
|[2:125]     [2:126]                                                    |BASE (SEC): 1.0|-(DN)
|                                                                       |PRESET:       5|
|                                                                       |ACCUM:        5|
|                                                                       +---------------+
T4:118.DN - -| |- - File #5 FAULTS -  103
Rung #103
|FAULT        DWELL 3
|DETECT       CHAMBER                                                          CRYO VALVE
|CRYO VALVE   GATE VALVE                                                       6 THROTTLE
|6 THROTTLE   THROTTLED                                                        FAULT
|CV6THTMR     HV6S2                                                            CV6THFLT
|  T4:118       I:024                                                             B3
 ---| |---------|/|-----------------------------------------------------------( )---
    DN          04                                                                238
|[102]
B3/238 - -|/|- - File #5 FAULTS -  116
         -( )- - File #5 FAULTS -  103
```

625

Rung #104

```
|CRYO GATE    CRYO GATE
|SOLENOID 1   SOLENOID 2                                       CRYO VALVE
|DWELL 4      DWELL 4                                          7 THROTTLE
|CHAMBER      CHAMBER                                          TIMER
|HV7_1        HV7_2                                            CV7THTMR
|  0:045        0:045                                          +--TON------------+
|---|/|---------| |--------------------------------------------|TIMER ON DELAY   |-(EN)-
|    11          12                                            |TIMER:    T4:119 |
|[2:127]      [2:128]                                          |BASE (SEC):  1.0 |-(DN)
|                                                              |PRESET:        5 |
|                                                              |ACCUM:         5 |
|                                                              +-----------------+
T4:119.DN - -| |- - File #5 FAULTS -  105
```

Rung #105

```
|FAULT        DWELL 4
|DETECT       CHAMBER                                                CRYO VALVE
|CRYO VALVE   GATE VALVE                                             7 THROTTLE
|7 THROTTLE   THROTTLED                                              FAULT
|CV7THTMR     HV7S2                                                  CV7THFLT
|  T4:119       I:036                                                   B3
|---| |---------|/|-------------------------------------------------------( )---
|    DN          07                                                     239
|[104]
B3/239 - -|/|- - File #5 FAULTS -  116
         -( )- - File #5 FAULTS -  105
```

Rung #106

```
 CRYO GATE    CRYO GATE
|SOLENOID 1   SOLENOID 2                                       CRYO VALVE
|BUFFER 3     BUFFER 3                                         8 THROTTLE
|CHAMBER      CHAMBER                                          TIMER
|HV8_1        HV8_2                                            CV8THTMR
|  0:045        0:045                                          +--TON------------+
|---|/|---------| |--------------------------------------------|TIMER ON DELAY   |-(EN)-
|    13          14                                            |TIMER:    T4:120 |
|[2:129]      [2:130]                                          |BASE (SEC):  1.0 |-(DN)
|                                                              |PRESET:        5 |
|                                                              |ACCUM:         5 |
|                                                              +-----------------+
T4:120.DN - -| |- - File #5 FAULTS -  107
```

Rung #107

```
|FAULT        BUFFER 3
|DETECT       CHAMBER                                                CRYO VALVE
|CRYO VALVE   GATE VALVE                                             8 THROTTLE
|8 THROTTLE   THROTTLED                                              FAULT
|CV8THTMR     HV8S2                                                  CV8THFLT
|  T4:120       I:040                                                   B3
|---| |---------|/|-------------------------------------------------------( )---
|    DN          01                                                     240
|[106]
B3/240 - -|/|- - File #5 FAULTS -  116
         -( )- - File #5 FAULTS -  107
```

626

```
Rung #108
|CRYO GATE    CRYO GATE                                                   CRYO VALVE           |
|SOLENOID 1   SOLENOID 2                                                  9 THROTTLE           |
|DWELL 5      DWELL 5                                                     TIMER                |
|CHAMBER      CHAMBER                                                     CV9THTMR             |
|HV9_1        HV9_2                                                       +-TON--------------+ |
|  O:045        O:045                                                    -|TIMER ON DELAY    |-(EN)-|
|---|/|---------| |-------------------------------------------------------|TIMER:     T4:121 |      |
|    15           16                                                      |BASE (SEC):   1.0 |-(DN) |
|[2:131]      [2:132]                                                     |PRESET:         5 |      |
|                                                                         |ACCUM:          5 |      |
|                                                                         +------------------+      |
|
T4:121.DN - -| |- - File #5 FAULTS -  109
Rung #109
|FAULT        DWELL 5                                                           CRYO VALVE |
|DETECT       CHAMBER                                                           9 THROTTLE |
|CRYO VALVE   GATE VALVE                                                        FAULT      |
|9 THROTTLE   THROTTLED                                                         CV9THFLT   |
|CV9THTMR     HV9S2                                                                 B3     |
|  T4:121       I:040                                                                      |
|---| |----------|/|-------------------------------------------------------------( )-------|
|    DN           04                                                               241     |
|[108]
B3/241 - -|/|- - File #5 FAULTS -  116
         -( )- - File #5 FAULTS -  109
Rung #110
|  O GATE     CRYO GATE                                                   CRYO VALVE           |
|SOLENOID 1   SOLENOID 2                                                  10THROTTLE           |
|DWELL 6      DWELL 6                                                     TIMER                |
|CHAMBER      CHAMBER                                                     CV10THTMR            |
|HV10_1       HV10_2                                                      +-TON--------------+ |
|  O:061        O:061                                                    -|TIMER ON DELAY    |-(EN)-|
|---| |----------|/|------------------------------------------------------|TIMER:     T4:122 |      |
|    11           12                                                      |BASE (SEC):   1.0 |-(DN) |
|[2:133]      [2:134]                                                     |PRESET:         5 |      |
|                                                                         |ACCUM:          0 |      |
|                                                                         +------------------+      |
|
T4:122.DN - -| |- - File #5 FAULTS -  111
Rung #111
|FAULT        DWELL 6                                                           CRYO VALVE |
|DETECT       CHAMBER                                                           10THROTTLE |
|CRYO VALVE   GATE VALVE                                                        FAULT      |
|10THROTTLE   THROTTLED                                                         CV10THFLT  |
|CV10THTMR    HV10S2                                                                B3     |
|  T4:122       I:052                                                                      |
|---| |----------|/|-------------------------------------------------------------( )-------|
|    DN           07                                                               242     |
 .10]
B3/242 - -|/|- - File #5 FAULTS -  116
         -( )- - File #5 FAULTS -  111
```

627

```
Rung #112
|CRYO GATE    CRYO GATE                                        CRYO VALVE            |
|SOLENOID 1   SOLENOID 2                                       11THROTTLE            |
|BUFFER 4     BUFFER 4                                         TIMER                 |
|CHAMBER      CHAMBER                                          CV11THTMR             |
|HV11_1       HV11_2                                           +-TON--------------+  |
|   0:061       0:061                                          |TIMER ON DELAY    |-(EN)-|
|----|/|---------| |-------------------------------------------|TIMER:     T4:123|      |
|     13          14                                           |BASE (SEC):   1.0|-(DN) |
|[2:135]      [2:136]                                          |PRESET:         5|      |
|                                                              |ACCUM:          5|      |
|                                                              +------------------+      |
T4:123.DN - -| |- - File #5 FAULTS - 113
Rung #113
|FAULT        BUFFER 4                                                  CRYO VALVE |
|DETECT       CHAMBER                                                   11THROTTLE |
|CRYO VALVE   GATE VALVE                                                FAULT      |
|11THROTTLE   THROTTLED                                                 CV11THFLT  |
|CV11THTMR    HV11S2                                                       B3      |
|  T4:123       I:054                                                              |
|----| |----------|/|------------------------------------------------------( )-----|
|     DN          01                                                      243      |
|[112]
B3/243 - -|/|- - File #5 FAULTS - 116
        -( )- - File #5 FAULTS - 113
Rung #114
|  YO GATE    CRYO GATE                                        CRYO VALVE            |
|SOLENOID 1   SOLENOID 2                                       12THROTTLE            |
|EXBUFFER     EXBUFFER                                         TIMER                 |
|CHAMBER      CHAMBER                                          CV12THTMR             |
|HV12_1       HV12_2                                           +-TON--------------+  |
|   0:061       0:061                                          |TIMER ON DELAY    |-(EN)-|
|----|/|---------| |-------------------------------------------|TIMER:     T4:124|      |
|     15          16                                           |BASE (SEC):   1.0|-(DN) |
|[2:137]      [2:138]                                          |PRESET:         5|      |
|                                                              |ACCUM:          5|      |
|                                                              +------------------+      |
T4:124.DN - -| |- - File #5 FAULTS - 115
Rung #115
|FAULT        EXIT                                                      CRYO VALVE |
|DETECT       BUFFER                                                    12THROTTLE |
|CRYO VALVE   GATE VALVE                                                FAULT      |
|12THROTTLE   THROTTLED                                                 CV12THFLT  |
|CV12THTMR    HV12S2                                                       B3      |
|  T4:124       I:054                                                              |
|----| |----------|/|------------------------------------------------------( )-----|
|     DN          04                                                      244      |
 [114]
B3/244 - -|/|- - File #5 FAULTS - 116
        -( )- - File #5 FAULTS - 115
Rung #116
|CRYO VALVE  CRYO VALVE  CRYO VALVE  CRYO VALVE  CRYO VALVE  CRYO VALVE  CRYO VALVE  CRYO VALVE  CRYO VALVE  CRYO VALVE
|2 THROTTLE  3 THROTTLE  4 THROTTLE  5 THROTTLE  6 THROTTLE  7 THROTTLE  8 THROTTLE  9 THROTTLE  10THROTTLE  11THROTTLE
|FAULT       FAULT       FAULT       FAULT       FAULT       FAULT       FAULT       FAULT       FAULT       FAULT
|CV2THFLT    CV3THFLT    CV4THFLT    CV5THFLT    CV6THFLT    CV7THFLT    CV8THFLT    CV9THFLT    CV10THFLT   CV11THFLT
|   B3          B3          B3          B3          B3          B3          B3          B3          B3          B3
|---|/|---------|/|---------|/|---------|/|---------|/|---------|/|---------|/|---------|/|---------|/|---------|/|---
|   234         235         236         237         238         239         240         241         242         243
|[95]        [97]        [99]        [101]       [103]       [105]       [107]       [109]       [111]       [113]
                                                                                          CRYO VALVE  CRYO VALVE |
                                                                                          12THROTTLE  THROTTLE   |
                                                                                                                 >
```

```
                                              FAULT       FAULT
                                              CV12THFLT   CVTHFLT
                                                 B3          B3
                                              ---]/[------( )---
                                                 244        311
                                              [115]
B3/311 - -]/[- - File #5 FAULTS -  142
          -( )- - File #5 FAULTS -  116
Rung #117
|CRYO GATE                                    CYRO VALVE
|HEATER 1                                     1 CLOSE
|CHAMBER                                      TIMER
|HV1                                          CV1CLTMR
|   O:011                                     +-TON----------------+
|---]/[-------------------------------------- |TIMER ON DELAY      |-(EN)-
|    11                                       |TIMER:        T4:131|
|[2:115]                                      |BASE (SEC):      1.0|-(DN)
|                                             |PRESET:            7|
|                                             |ACCUM:             0|
|                                             +--------------------+
T4:131.DN - -] [- - File #5 FAULTS -  118
Rung #118
|FAULT        HEATER 1                          CRYO VALVE
|DETECT       CHAMBER                           1 CLOSE
|CRYO VALVE   GATE VALVE                        FAULT
|1 CLOSE      CLOSE                             CV1CLFLT
 1CLTMR       HV1S1                                B3
|  T4:131      I:002
|---] [--------]/[-------------------------------( )---
|    DN         06                                151
|[117]
B3/151 - -]/[- - File #5 FAULTS -. 141
         -( )- - File #5 FAULTS -  118
Rung #119
|CRYO GATE    CRYO GATE
|SOLENOID 1   SOLENOID 2                      CRYO VALVE
|HEATER 2     HEATER 2                        2 CLOSE
|CHAMBER      CHAMBER                         TIMER
|HV2_1        HV2_2                           CV2CLTMR
|  O:011       O:011                          +-TON----------------+
|---]/[--------]/[--------------------------- |TIMER ON DELAY      |-(EN)-
|    13         14                            |TIMER:        T4:132|
|[2:117]      [2:118]                         |BASE (SEC):      1.0|-(DN)
|                                             |PRESET:            5|
|                                             |ACCUM:             0|
|                                             +--------------------+
T4:132.DN - -] [- - File #5 FAULTS -  120
Rung #120
 AULT         HEATER 2                          CRYO VALVE
|DETECT       CHAMBER                           2 CLOSE
|CRYO VALVE   GATE VALVE                        FAULT
|2 CLOSE      CLOSE                             CV2CLFLT
|CV2CLTMR     HV2S1                                B3
|  T4:132      I:004
|---] [--------]/[-------------------------------( )---
|    DN         00                                152
|[119]
B3/152 - -]/[- - File #5 FAULTS -  141
         -( )- - File #5 FAULTS -  120
```

```
Rung #121
|CRYO GATE    CRYO GATE                                                        |
|SOLENOID 1   SOLENOID 2                                     CRYO VALVE        |
|DWELL 1      DWELL 1                                        3 CLOSE           |
|CHAMBER      CHAMBER                                        TIMER             |
|HV3_1        HV3_2                                          CV3CLTMR          |
|  O:011        O:011                                        +--TON-----------+|
|---]/[---------]/[------------------------------------------+TIMER ON DELAY  +-(EN)-|
|   15           16                                          |TIMER:   T4:133 |      |
|[2:119]      [2:120]                                        |BASE (SEC): 1.0 +-(DN) |
|                                                            |PRESET:       5 |      |
|                                                            |ACCUM:        0 |      |
|                                                            +----------------+      |
T4:133.DN - ] [ - File #5 FAULTS -  122
Rung #122
|FAULT        DWELL 1                                                          |
|DETECT       CHAMBER                                               CRYO VALVE |
|CRYO VALVE   GATE VALVE                                            3 CLOSED   |
|3 CLOSE      CLOSED                                                FAULT      |
|CV3CLTMR     HV3S1                                                 CV3CLFLT   |
|  T4:133       I:004                                                  B3      |
|---] [---------]/[----------------------------------------------------( )-----|
|   DN           03                                                    153     |
|[121]                                                                         |
B3/153 - ]/[ - File #5 FAULTS -  141
       -( )- - File #5 FAULTS -  122
"ung #123
 RYO GATE    CRYO GATE                                                         |
|SOLENOID 1   SOLENOID 2                                     CRYO VALVE        |
|DWELL 2      DWELL 2                                        4 CLOSE           |
|CHAMBER      CHAMBER                                        TIMER             |
|HV4_1        HV4_2                                          DV4CLFLT          |
|  O:031        O:031                                        +--TON-----------+|
|---]/[---------]/[------------------------------------------+TIMER ON DELAY  +-(EN)-|
|   11           12                                          |TIMER:   T4:134 |      |
|[2:121]      [2:122]                                        |BASE (SEC): 1.0 +-(DN) |
|                                                            |PRESET:       5 |      |
|                                                            |ACCUM:        0 |      |
|                                                            +----------------+      |
T4:134.DN - ] [ - File #5 FAULTS -  124
Rung #124
|FAULT        DWELL 2                                                          |
|DETECT       CHAMBER                                               CRYO VALVE |
|CRYO VALVE   GATE VALVE                                            4 CLOSE    |
|4 CLOSE      CLOSED                                                FAULT      |
|DV4CLFLT     HV4S1                                                 CV4CLFLT   |
|  T4:134       I:022                                                  B3      |
|---] [---------]/[----------------------------------------------------( )-----|
    DN           06                                                    154     |
 .123]                                                                         |
B3/154 - ]/[ - File #5 FAULTS -  141
       -( )- - File #5 FAULTS -  124
```

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```
Rung #125
|CRYO GATE    CRYO GATE                                          CRYO VALVE          |
|SOLENOID 1   SOLENOID 2                                         5 CLOSE             |
|HEATER 2     HEATER 2                                           TIMER               |
|CHAMBER      CHAMBER                                            CVSCLTRM            |
|HV5_1        HV5_2                                              +-TON------------+  |
|  O:031       O:031                                             |TIMER ON DELAY  |-(EN)-|
|---|/|--------|/|-----------------------------------------------|TIMER:    T4:135|  |
|    13         14                                               |BASE (SEC):  1.0|-(DN) |
|[2:123]      [2:124]                                            |PRESET:        5|  |
|                                                                |ACCUM:         0|  |
|                                                                +----------------+  |
T4:135.DN - -| |- - File #5 FAULTS -  126
Rung #126
|FAULT        HEATER 3                                                 CRYO VALVE |
|DETECT       CHAMBER                                                  5 CLOSE    |
|CRYO VALVE   GATE VALVE                                               FAULT      |
|5 CLOSE      CLOSED                                                   CVSCLFLT   |
|CVSCLTRM     HV5S1                                                       B3      |
|  T4:135      I:024                                                             |
|---| |---------|/|-------------------------------------------------------( )------|
|    DN          00                                                      155      |
|[125]
B3/155 - -|/|- - File #5 FAULTS -  141
         -( )- - File #5 FAULTS -  126
Rung #127
  YO GATE     CRYO GATE                                          CRYO VALVE          |
 .LENOID 1    SOLENOID 2                                         6 CLOSE             |
|DWELL 3      DWELL 3                                            TIMER               |
|CHAMBER      CHAMBER                                            CV6CLTMR            |
|HV6_1        HV6_2                                              +-TON------------+  |
|  O:031       O:031                                             |TIMER ON DELAY  |-(EN)-|
|---|/|--------|/|-----------------------------------------------|TIMER:    T4:136|  |
|    15         16                                               |BASE (SEC):  1.0|-(DN) |
|[2:125]      [2:126]                                            |PRESET:        5|  |
|                                                                |ACCUM:         0|  |
|                                                                +----------------+  |
T4:136.DN - -| |- - File #5 FAULTS -  128
Rung #128
|FAULT        DWELL 3                                                  CRYO VALVE |
|DETECT       CHAMBER                                                  6 CLOSE    |
|CRYO VALVE   GATE VALVE                                               FAULT      |
|6 CLOSE      CLOSED                                                   CV6CLFLT   |
|CV6CLTMR     HV6S1                                                       B3      |
|  T4:136      I:024                                                             |
|---| |---------|/|-------------------------------------------------------( )------|
|    DN          03                                                      156      |
 '27]
 ,156 - -|/|- - File #5 FAULTS -  141
        -( )- - File #5 FAULTS -  128
```

```
Rung #129
|CRYO GATE    CRYO GATE                                                                   |
|SOLENOID 1   SOLENOID 2                                               CRYO VALVE         |
|DWELL 4      DWELL 4                                                  7 CLOSE            |
|CHAMBER      CHAMBER                                                  TIMER              |
|HV7_1        HV7_2                                                    CV7CLTMR           |
|   O:045        O:045                                                 +--TON-----------+ |
|----]/[--------]/[----------------------------------------------------+TIMER ON DELAY  +-(EN)-|
|    11          12                                                    |TIMER:  T4:137  | |
|[2:127]     [2:128]                                                   |BASE (SEC): 1.0 +-(DN)|
|                                                                      |PRESET:        5| |
|                                                                      |ACCUM:         0| |
|                                                                      +----------------+ |
T4:137.DN - ] [ - File #5 FAULTS - 130
Rung #130
|FAULT        DWELL 4                                                                     |
|DETECT       CHAMBER                                                           CRYO VALVE |
|CRYO VALVE   GATE VALVE                                                        7 CLOSE    |
|7 CLOSE      CLOSED                                                            FAULT      |
|CV7CLTMR     HV7S1                                                             DV7CLFLT   |
|  T4:137       I:036                                                              B3      |
|----] [--------]/[-------------------------------------------------------------( )-------|
|    DN          06                                                               157      |
|[129]                                                                                     |
B3/157 - ]/[ - File #5 FAULTS - 141
       -( )- - File #5 FAULTS - 130
Rung #131
|  YO GATE    CRYO GATE                                                                   |
|SOLENOID 1   SOLENOID 2                                               CRYO VALVE         |
|BUFFER 3     BUFFER 3                                                 8 CLOSE            |
|CHAMBER      CHAMBER                                                  TIMER              |
|HV8_1        HV8_2                                                    CV8CLTMR           |
|   O:045        O:045                                                 +--TON-----------+ |
|----]/[--------]/[----------------------------------------------------+TIMER ON DELAY  +-(EN)-|
|    13          14                                                    |TIMER:  T4:138  | |
|[2:129]     [2:130]                                                   |BASE (SEC): 1.0 +-(DN)|
|                                                                      |PRESET:        5| |
|                                                                      |ACCUM:         0| |
|                                                                      +----------------+ |
T4:138.DN - ] [ - File #5 FAULTS - 132
Rung #132
|FAULT        BUFFER 3                                                                    |
|DETECT       CHAMBER                                                           CRYO VALVE |
|CRYO VALVE   GATE VALVE                                                        8 CLOSE    |
|8 CLOSE      CLOSED                                                            FAULT      |
|CV8CLTMR     HV8S1                                                             CV8CLFLT   |
|  T4:138       I:040                                                              B3      |
|----] [--------]/[-------------------------------------------------------------( )-------|
     DN          00                                                               158      |
 [131]                                                                                     |
B3/158 - ]/[ - File #5 FAULTS - 141
       -( )- - File #5 FAULTS - 132
```

```
Rung #133
|CRYO GATE    CRYO GATE                                                                              |
|SOLENOID 1   SOLENOID 2                                                        CRYO VALVE           |
|DWELL 5      DWELL 5                                                           9 CLOSE              |
|CHAMBER      CHAMBER                                                           TIMER                |
|HV9_1        HV9_2                                                             CV9CLTMR             |
|  0:045        0:045                                                           +--TON-----------+   |
|----|/|--------|/|-------------------------------------------------------------|TIMER ON DELAY  |-(EN)-|
|    15          16                                                             |TIMER:   T4:139 |   |
|[2:131]     [2:132]                                                            |BASE (SEC):  1.0|-(DN) |
|                                                                               |PRESET:       5 |   |
|                                                                               |ACCUM:        0 |   |
|                                                                               +----------------+   |
T4:139.DN - -| |- - File #5 FAULTS -  134
Rung #134
|FAULT        DWELL 5                                                                                |
|DETECT       CHAMBER                                                                   CRYO VALVE   |
|CRYO VALVE   GATE VALVE                                                                9 CLOSE      |
|9 CLOSE      CLOSED                                                                    FAULT        |
|CV9CLTMR     HV9S1                                                                     CV9CLFLT     |
|  T4:139      I:040                                                                       B3        |
|----| |--------|/|-----------------------------------------------------------------------( )--------|
|    DN          03                                                                        159       |
|[133]
B3/159 - -|/|- - File #5 FAULTS -  141
         -( )- - File #5 FAULTS -  134
Rung #135
|CRYO GATE    CRYO GATE                                                                              |
|SOLENOID 1   SOLENOID 2                                                        CRYO VALVE           |
|DWELL 6      DWELL 6                                                           10 CLOSE             |
|CHAMBER      CHAMBER                                                           TIMER                |
|HV10_1       HV10_2                                                            CV10CLTMR            |
|  0:061        0:061                                                           +--TON-----------+   |
|----|/|--------|/|-------------------------------------------------------------|TIMER ON DELAY  |-(EN)-|
|    11          12                                                             |TIMER:   T4:140 |   |
|[2:133]     [2:134]                                                            |BASE (SEC):  1.0|-(DN) |
|                                                                               |PRESET:       5 |   |
|                                                                               |ACCUM:        0 |   |
|                                                                               +----------------+   |
T4:140.DN - -| |- - File #5 FAULTS -  136
Rung #136
|FAULT        DWELL 6                                                                                |
|DETECT       CHAMBER                                                                   CRYO VALVE   |
|CRYO VALVE   GATE VALVE                                                                10 CLOSE     |
|10 CLOSE     CLOSED                                                                    FAULT        |
|CV10CLTMR    HV10S1                                                                    CV10CLFLT    |
|  T4:140      I:052                                                                       B3        |
|----| |--------|/|-----------------------------------------------------------------------( )--------|
|    DN          06                                                                        160       |
|[135]
B3/160 - -|/|- - File #5 FAULTS -  141
         -( )- - File #5 FAULTS -  136
```

```
Rung #137
|CRYO GATE    CRYO GATE                                                     CRYO VALVE             |
|SOLENOID 1   SOLENOID 2                                                    11 CLOSE               |
|BUFFER 4     BUFFER 4                                                      TIMER                  |
|CHAMBER      CHAMBER                                                       CV11CLTMR              |
|HV11_1       HV11_2                                                        +-TON-------------+    |
|  O:061        O:061                                                       |                 |    |
|---|/|----------|/|--------------------------------------------------------+TIMER ON DELAY   +-(EN)-|
|    13           14                                                        |TIMER:    T4:141 |    |
|[2:135]      [2:136]                                                       |BASE (SEC):  1.0+-(DN) |
|                                                                           |PRESET:        5 |    |
|                                                                           |ACCUM:         0 |    |
|                                                                           +-----------------+    |
T4:141.DN - ┤ ├ - File #5 FAULTS -  138
Rung #138
|FAULT        BUFFER 4                                                             CRYO VALVE      |
|DETECT       CHAMBER                                                              11 CLOSE        |
|CRYO VALVE   GATE VALVE                                                           FAULT           |
|11 CLOSE     CLOSED                                                               CV11CLFLT       |
|CV11CLTMR    HV11S1                                                                   B3          |
|  T4:141       I:054                                                                              |
|---| |----------|/|------------------------------------------------------------------( )---------|
|    DN           00                                                                   161         |
|[137]
B3/161 - ┤/├ - File #5 FAULTS -  141
         -( )- - File #5 FAULTS -  138
Rung #139
|CRYO GATE    CRYO GATE                                                     CRYO VALVE             |
|SOLENOID 1   SOLENOID 2                                                    12 CLOSE               |
|EXBUFFER     EXBUFFER                                                      TIMER                  |
|CHAMBER      CHAMBER                                                       CV12CLTMR              |
|HV12_1       HV12_2                                                        +-TON-------------+    |
|  O:061        O:061                                                       |                 |    |
|---|/|----------|/|--------------------------------------------------------+TIMER ON DELAY   +-(EN)-|
|    15           16                                                        |TIMER:    T4:142 |    |
|[2:137]      [2:138]                                                       |BASE (SEC):  1.0+-(DN) |
|                                                                           |PRESET:        5 |    |
|                                                                           |ACCUM:         0 |    |
|                                                                           +-----------------+    |
T4:142.DN - ┤ ├ - File #5 FAULTS -  140
Rung #140
|FAULT        EXITLOCK                                                             CRYO VALVE      |
|DETECT       CHAMBER                                                              12 CLOSE        |
|CRYO VALVE   GATE VALVE                                                           FAULT           |
|12 CLOSE     CLOSED                                                               CV12CLFLT       |
|CV12CLTMR    HV12S1                                                                   B3          |
|  T4:142       I:054                                                                              |
|---| |----------|/|------------------------------------------------------------------( )---------|
|    DN           03                                                                   162         |
|[139]
B3/162 - ┤/├ - File #5 FAULTS -  141
         -( )- - File #5 FAULTS -  140
Rung #141
|CRYO VALVE  CRYO VALVE  CRYO VALVE  CRYO VALVE  CRYO VALVE  CRYO VALVE  CRYO VALVE  CRYO VALVE  CRYO VALVE  CRYO VALVE
|1 CLOSE     2 CLOSE     3 CLOSED    4 CLOSE     5 CLOSE     6 CLOSE     7 CLOSE     8 CLOSE     9 CLOSE     10 CLOSE
|FAULT       FAULT       FAULT       FAULT       FAULT       FAULT       FAULT       FAULT       FAULT       FAULT
|CV1CLFLT    CV2CLFLT    CV3CLFLT    CV4CLFLT    CV5CLFLT    CV6CLFLT    DV7CLFLT    CV8CLFLT    CV9CLFLT    CV10CLFLT
|   B3          B3          B3          B3          B3          B3          B3          B3          B3          B3
|---|/|---------|/|---------|/|---------|/|---------|/|---------|/|---------|/|---------|/|---------|/|---------|/|----
|   151         152         153         154         155         156         157         158         159         160
|[118]       [120]       [122]       [124]       [126]       [128]       [130]       [132]       [134]       [136]
                                                                                   CRYO VALVE  CRYO VALVE  CRYO VALVE  |
                                                                                   11 CLOSE    12 CLOSE    CLOSE       |
                                                                                                                       >
```

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```
                                                          FAULT      FAULT      FAULT      |
                                                          CV11CLFLT  CV12CLFLT  CVCLFLT    |
                                                            B3         B3         B3       |
                                                         ---|/|--------|/|--------( )------|
                                                            161        162        313      |
                                                          [138]      [140]                 |
B3/313 - -|/|- - File #5 FAULTS -  142
         -( )- - File #5 FAULTS -  141
Rung #142
|CRYO VALVE             CRYO VALVE                                                         |
|THROTTLE    CRYO VALVE CLOSE                                                 HIVAC VALVE  |
|FAULT       OPEN FAULT FAULT                                                 FAULT        |
|CVTHFLT     CVOPFLT    CVCLFLT                                               HVFLT        |
|   B3          B3         B3                                                    B3        |
|---|/|---------|/|--------|/|-----------------------------------------------------(L)------|
|   311         312        313                                                   245       |
|[116]       [93]       [141]                                                              |
B3/245 - -| |- - File #2 MAIN_PRGRM -  625
         -(L)- - File #5 FAULTS -  142
         -(U)- - File #5 FAULTS -  143
Rung #143
|PAUSE                                                                        HIVAC VALVE  |
|DISABLE                                                                      FAULT        |
|TS12                                                                         HVFLT        |
|  N7:16                                                                         B3        |
|---| |--------------------------------------------------------------------------(U)-------|
|    4                                                                           245       |
|[2:3]                                                                                     |
B3/245 - -| |- - File #2 MAIN_PRGRM -  625
         -(L)- - File #5 FAULTS -  142
         -(U)- - File #5 FAULTS -  143
Rung #144
|                                                                    OPEN                  |
|OPEN                                                                CHAMBER               |
|DWELL 2                                                             VENT VALVE            |
|VENT VALVE                                                          2 TIMER               |
|CV2                                                                 OPCHV2T               |
|   O:007                                                            +--TON--------------+ |
|----| |-------------------------------------------------------------|TIMER ON DELAY     |-(EN)-|
|     17                                                             |TIMER:       T4:145|     |
|[2:396]                                                             |BASE (SEC):     1.0|-(DN) |
|                                                                    |PRESET:           5|     |
|                                                                    |ACCUM:            0|     |
|                                                                    +-------------------+     |
T4:145.DN - -| |- - File #5 FAULTS -  145
Rung #145
|FAULT                                                                                      |
|'ETECT       DWELL 1                                                          CHAMBER      |
| AMBER       CHAMBER                                                          VENT VALVE   |
|VENT VALVE   VENT VALVE                                                       2 OPEN       |
|2 OPEN       OPEN                                                             FAULT        |
|OPCHV2T      CVS4                                                             CHV2OPF      |
|  T4:145      I:002                                                              B3        |
|----| |---------|/|---------------------------------------------------------------( )------|
|     DN          14                                                               165      |
|[144]                                                                                      |
B3/165 - -|/|- - File #5 FAULTS -  156
         -( )- - File #5 FAULTS -  145
```

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```
Rung #146
|                                                                   CLOSE                        |
|OPEN                                                               CHAMBER                      |
|DWELL 2                                                            VENT VALVE                   |
|VENT VALVE                                                         2 TIMER                      |
|CV2                                                                CLCHV2T                      |
|  0:007                                                            ┌─TON──────────────┐         |
├──┤/├──────────────────────────────────────────────────────────────┤TIMER ON DELAY    ├─(EN)─┤
|    17                                                             |TIMER:     T4:146|         |
|[2:396]                                                            |BASE (SEC):   1.0├─(DN)   |
|                                                                   |PRESET:         5|         |
|                                                                   |ACCUM:          5|         |
|                                                                   └──────────────────┘         |
T4:146.DN - ┤ ├ - File #5 FAULTS -  147
Rung #147
|FAULT                                                                                          |
|DETECT      DWELL 1                                                             CHAMBER        |
|CHAMBER     CHAMBER                                                             VENT VALVE     |
|VENT VALVE  VENT VALVE                                                          2 CLOSE        |
|2 CLOSE     CLOSED                                                              FAULT          |
|CLCHV2T     CVS3                                                                CHV2CLF        |
|  T4:146      I:002                                                                  B3        |
├──┤ ├────────┤/├─────────────────────────────────────────────────────────────────────( )──────┤
|    DN         13                                                                    166       |
|[146]                                                                                          |
B3/166 - ┤/├ - File #5 FAULTS -  156
       -( )- - File #5 FAULTS -  147
  ng #148
|                                                                   OPEN                         |
|OPEN                                                               CHAMBER                      |
|DWELL 3                                                            VENT VALVE                   |
|VENT VALVE                                                         3 TIMER                      |
|CV3                                                                OPCHV3T                      |
|  0:027                                                            ┌─TON──────────────┐         |
├──┤ ├──────────────────────────────────────────────────────────────┤TIMER ON DELAY    ├─(EN)─┤
|    16                                                             |TIMER:     T4:147|         |
|[2:401]                                                            |BASE (SEC):   1.0├─(DN)   |
|                                                                   |PRESET:         5|         |
|                                                                   |ACCUM:          0|         |
|                                                                   └──────────────────┘         |
T4:147.DN - ┤ ├ - File #5 FAULTS -  149
Rung #149
|FAULT                                                                                          |
|DETECT      DWELL 3                                                             CHAMBER        |
|CHAMBER     CHAMBER                                                             VENT VALVE     |
|VENT VALVE  VENT VALVE                                                          3 OPEN         |
|3 OPEN      OPEN                                                                FAULT          |
|OPCHV3T     CVS6                                                                CHV3OPF        |
'  T4:147      I:022                                                                  B3        |
   ┤ ├────────┤/├─────────────────────────────────────────────────────────────────────( )──────┤
|    DN         12                                                                    167       |
|[148]                                                                                          |
B3/167 - ┤/├ - File #5 FAULTS -  156
       -( )- - File #5 FAULTS -  149
```

```
Rung #150                                                        CLOSE
|                                                                CHAMBER
|OPEN                                                            VENT VALVE
|DWELL 3                                                         3 TIMER
|VENT VALVE                                                      CLCHV3T
|CV3                                                             +-TON-----------------+
|   O:027                                                        |TIMER ON DELAY       |-(EN)-
|---]/[----------------------------------------------------------|TIMER:       T4:148  |
|    16                                                          |BASE (SEC):     1.0  |-(DN)
|[2:401]                                                         |PRESET:          5   |
|                                                                |ACCUM:           5   |
|                                                                +---------------------+
|
T4:148.DN - ] [ - File #5 FAULTS - 151
```

```
Rung #151
|FAULT                                                                   CHAMBER
|DETECT       DWELL 4                                                    VENT VALVE
|CHAMBER      CHAMBER                                                    3 CLOSE
|VENT VALVE   VENT VALVE                                                 FAULT
|3 CLOSE      CLOSED                                                     CHV3CLF
|CLCHV3T      CVS5                                                            B3
|  T4:148      I:022                                                          
|---] [---------]/[-------------------------------------------------------( )---
|    DN         11                                                           168
|[150]
B3/168 - ]/[ - File #5 FAULTS - 156
         -( )- - File #5 FAULTS - 151
```

```
ng #152                                                          OPEN
|                                                                CHAMBER
|OPEN                                                            VENT VALVE
|DWELL 5                                                         4 TIMER
|VENT VALVE                                                      OPCHV4T
|CV4                                                             +-TON-----------------+
|   O:043                                                        |TIMER ON DELAY       |-(EN)-
|---] [----------------------------------------------------------|TIMER:       T4:149  |
|    16                                                          |BASE (SEC):     1.0  |-(DN)
|[2:403]                                                         |PRESET:          5   |
|                                                                |ACCUM:           0   |
|                                                                +---------------------+
|
T4:149.DN - ] [ - File #5 FAULTS - 153
```

```
Rung #153
|FAULT                                                                   CHAMBER
|DETECT       DWELL 5                                                    VENT VALVE
|CHAMBER      CHAMBER                                                    4 OPEN
|VENT VALVE   VENT VALVE                                                 FAULT
|4 OPEN       OPEN                                                       CHV4OPF
|OPCHV4T      CVS8                                                            B3
   T4:149      I:036
 ---] [---------]/[-------------------------------------------------------( )---
|    DN         12                                                           169
|[152]
B3/169 - ]/[ - File #5 FAULTS - 156
         -( )- - File #5 FAULTS - 153
```

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```
Rung #154
|                                                                            CLOSE                |
|OPEN                                                                        CHAMBER              |
|DWELL 5                                                                     VENT VALVE           |
|VENT VALVE                                                                  4 TIMER              |
|CV4                                                                         CLCHV4T              |
|  O:043                                                                    +--TON-----------+    |
|---|/|--------------------------------------------------------------------+|TIMER ON DELAY  |-(EN)-|
|    16                                                                     |TIMER:    T4:150|      |
|[2:403]                                                                    |BASE (SEC):  1.0|-(DN) |
|                                                                           |PRESET:        5|      |
|                                                                           |ACCUM:         5|      |
|                                                                           +----------------+      |
T4:150.DN - -| |- - File #5 FAULTS - 155
Rung #155
|FAULT                                                                                            |
|DETECT      DWELL 5                                                              CHAMBER         |
|CHAMBER     CHAMBER                                                              VENT VALVE      |
|VENT VALVE  VENT VALVE                                                           4 CLOSE         |
|4 CLOSE     CLOSED                                                               FAULT           |
|CLCHV4T     CVS7                                                                 CHV4CLF         |
|  T4:150     I:036                                                                   B3          |
|---| |--------|/|--------------------------------------------------------------------( )---------|
|     DN        11                                                                    170         |
|[154]                                                                                            |
B3/170 - -|/|- - File #5 FAULTS - 156
         -( )- - File #5 FAULTS - 155
 ng #156
|CHAMBER     CHAMBER     CHAMBER     CHAMBER     CHAMBER     CHAMBER                               |
|VENT VALVE  VENT VALVE  VENT VALVE  VENT VALVE  VENT VALVE  VENT VALVE            CHAMBER         |
|2 OPEN      2 CLOSE     3 OPEN      3 CLOSE     4 OPEN      4 CLOSE               VENT VALVE      |
|FAULT       FAULT       FAULT       FAULT       FAULT       FAULT                 NO FAULT        |
|CHV2OPF     CHV2CLF     CHV3OPF     CHV3CLF     CHV4OPF     CHV4CLF               CHVNF           |
|   B3          B3          B3          B3          B3          B3                       B3         |
|---|/|--------|/|---------|/|---------|/|---------|/|---------|/|---------------------( )---------|
|   165         166         167         168         169         170                     173        |
|[145]       [147]       [149]       [151]       [153]       [155]                                 |
B3/173 - -|/|- - File #5 FAULTS - 157
         -( )- - File #5 FAULTS - 156
Rung #157
|CHAMBER                                                                          CHAMBER         |
|VENT VALVE                                                                       VENT VALVE      |
|NO FAULT                                                                         FAULT           |
|CHVNF                                                                            CHVF            |
|   B3                                                                                B3          |
|---|/|------------------------------------------------------------------------------(L)---------|
|   173                                                                               174         |
|[156]                                                                                            |
"3/174 - -| |- - File #2 MAIN_PRGRM - 625
         -(L)- - File #5 FAULTS - 157
         -(U)- - File #5 FAULTS - 158
Rung #158
|                                                                                 CHAMBER         |
|PAUSE                                                                            VENT VALVE      |
|DISABLE                                                                          FAULT           |
|TS12                                                                             CHVF            |
|  N7:16                                                                              B3          |
|---| |------------------------------------------------------------------------------(U)---------|
|    4                                                                                174         |
|[2:3]                                                                                            |
B3/174 - -| |- - File #2 MAIN_PRGRM - 625
         -(L)- - File #5 FAULTS - 157
```

```
      -(U)- - File #5 FAULTS -  158
Rung #159
|OPEN                                                              OPEN                     |
|LOAD LOCK                                                         ROUGH VENT               |
|ROUGH                                                             VALVE 1                  |
|VALVE                                                             TIMER                    |
|RV1                                                               OPRV1T                   |
|  O:010                                                          +-TON---------------+     |
|---] [-----------------------------------------------------------+TIMER ON DELAY     +-(EN)-|
|    11                                                           |TIMER:      T4:153 |     |
|[2:167]                                                          |BASE (SEC):    1.0 +-(DN) |
|                                                                 |PRESET:         23 |     |
|                                                                 |ACCUM:           0 |     |
|                                                                 +-------------------+     |
T4:153.DN - ] [ - File #5 FAULTS -  160
Rung #160
|FAULT       LLOCK                                                                         |
|DETECT      CHAMBER                                                                       |
|ROUGH VENT  ROUGH                                                       ROUGH VALVE 1     |
|VALVE 1     VALVE                                                       OPEN FAULT        |
|OPEN        OPEN                                                        RV1OPF            |
|OPRV1T      RVS2                                                             B3           |
|  T4:153    I:002                                                                         |
|---] [-------]/[-------------------------------------------------------------( )----------|
|    DN        16                                                             126          |
|[159]
B3/126 - ]/[ - File #5 FAULTS -  179
       -( )- - File #5 FAULTS -  160
Rung #161
|OPEN                                                              CLOSE                    |
|LOAD LOCK                                                         ROUGH VENT               |
|ROUGH                                                             VALVE 1                  |
|VALVE                                                             TIMER                    |
|RV1                                                               CLRV1T                   |
|  O:010                                                          +-TON---------------+     |
|---]/[-----------------------------------------------------------+TIMER ON DELAY     +-(EN)-|
|    11                                                           |TIMER:      T4:154 |     |
|[2:167]                                                          |BASE (SEC):    1.0 +-(DN) |
|                                                                 |PRESET:          5 |     |
|                                                                 |ACCUM:           4 |     |
|                                                                 +-------------------+     |
T4:154.DN - ] [ - File #5 FAULTS -  162
Rung #162
|FAULT       LLOCK                                                              ROUGH       |
|DETECT      CHAMBER                                                            VALVE 1     |
|ROUGH VENT  ROUGH                                                              CLOSE       |
|VALVE 1     VALVE                                                              FAULT       |
|CLOSE       CLOSED                                                             RV1CLF      |
|CLRV1T      RVS1                                                                 B3        |
|  T4:154    I:002                                                                          |
|---] [-------]/[---------------------------------------------------------------( )---------|
|    DN        15                                                                127        |
|[161]
B3/127 - ]/[ - File #5 FAULTS -  179
       -( )- - File #5 FAULTS -  162
```

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```
Rung #163
|OPEN                                                               OPEN              |
|DWELL 2                                                            ROUGH VENT        |
|ROUGH                                                              VALVE 2           |
|VALVE                                                              TIMER             |
|RV2                                                                OPRV2T            |
| O:030                                                            +-TON-----------+  |
|--] [-------------------------------------------------------------+TIMER ON DELAY +-(EN)-|
|  11                                                              |TIMER:  T4:155|  |
|[2:56]                                                            |BASE (SEC): 1.0+-(DN)|
|                                                                  |PRESET:      5|  |
|                                                                  |ACCUM:       0|  |
|                                                                  +--------------+  |
T4:155.DN - ] [ - File #5 FAULTS -  164
Rung #164
|FAULT        DWELL 2                                                                 |
|DETECT       CHAMBER                                                                 |
|ROUGH VENT   ROUGH                                                  ROUGH VALVE 2    |
|VALVE 2      VALVE                                                  OPEN FAULT       |
|OPEN         OPEN                                                   RV2OPF           |
|OPRV2T       RVS4                                                       B3           |
|  T4:155     I:022                                                                   |
|--] [--------]/[------------------------------------------------------( )-----------|
|    DN        16                                                       128           |
|[163]                                                                                |
B3/128 - ]/[ - File #5 FAULTS -  179
       -( )- - File #5 FAULTS -  164
  ng #165
|OPEN                                                               CLOSE             |
|DWELL 2                                                            ROUGH VENT        |
|ROUGH                                                              VALVE 2           |
|VALVE                                                              TIMER             |
|RV2                                                                CLRV2T            |
| O:030                                                            +-TON-----------+  |
|--]/[-------------------------------------------------------------+TIMER ON DELAY +-(EN)-|
|  11                                                              |TIMER:  T4:156|  |
|[2:56]                                                            |BASE (SEC): 1.0+-(DN)|
|                                                                  |PRESET:      5|  |
|                                                                  |ACCUM:       5|  |
|                                                                  +--------------+  |
T4:156.DN - ] [ - File #5 FAULTS -  166
Rung #166
|FAULT        DWELL 2                                                                 |
|DETECT       CHAMBER                                                                 |
|ROUGH VENT   ROUGH                                                  ROUGH VALVE 2    |
|VALVE 2      VALVE RV2                                              CLOSE FAULT      |
|CLOSE        CLOSED                                                 RV2CLF           |
|CLRV2T       RVS3                                                       B3           |
|  T4:156     I:022                                                                   |
|--] [--------]/[------------------------------------------------------( )-----------|
|    DN        15                                                       129           |
|[165]                                                                                |
B3/129 - ]/[ - File #5 FAULTS -  179
       -( )- - File #5 FAULTS -  166
```

```
Rung #167                                                              OPEN
|OPEN                                                                  ROUGH VENT
|DWELL 4                                                               VALVE 3
|ROUGH                                                                 TIMER
|VALVE                                                                 OPRV3T
|RV3                                                                  +-TON-----------------+
| O:044                                                               |TIMER ON DELAY       |-(EN)-
|--] [----------------------------------------------------------------|TIMER:       T4:157 |
|   11                                                                |BASE (SEC):     1.0 |-(DN)
|[2:57]                                                               |PRESET:           5 |
|                                                                     |ACCUM:            0 |
|                                                                     +---------------------+
T4:157.DN - -] [- - File #5 FAULTS -   168
Rung #168
|FAULT        DWELL 4
|DETECT       CHAMBER
|ROUGH VENT   ROUGH                                                        ROUGH VALVE 3
|VALVE 3      VALVE                                                        OPEN FAULT
|OPEN         OPEN                                                         RV3OPF
|OPRV3T       RVS6                                                              B3
|  T4:157      I:036                                                            
|--] [--------]/[-----------------------------------------------------------( )---
|    DN         16                                                             130
|[167]
B3/130 - -]/[- - File #5 FAULTS -  179
         -( )- - File #5 FAULTS -  168
  ng #169                                                              CLOSE
|OPEN                                                                  ROUGH VENT
|DWELL 4                                                               VALVE 1
|ROUGH                                                                 TIMER
|VALVE                                                                 CLRV3T
|RV3                                                                  +-TON-----------------+
| O:044                                                               |TIMER ON DELAY       |-(EN)-
|--]/[----------------------------------------------------------------|TIMER:       T4:158 |
|   11                                                                |BASE (SEC):     1.0 |-(DN)
|[2:57]                                                               |PRESET:           5 |
|                                                                     |ACCUM:            5 |
|                                                                     +---------------------+
T4:158.DN - -] [- - File #5 FAULTS -   170
Rung #170
|FAULT        DWELL 4
|DETECT       CHAMBER
|ROUGH VENT   ROUGH                                                        ROUGH VALVE 3
|VALVE 3      VALVE                                                        CLOSE FAULT
|CLOSE        CLOSED                                                       RV3CLF
|CLRV3T       RVS5                                                              B3
|  T4:158      I:036
   -] [--------]/[-----------------------------------------------------------( )---
|    DN         15                                                             131
|[169]
B3/131 - -]/[- - File #5 FAULTS -  179
         -( )- - File #5 FAULTS -  170
```

```
Rung #171
|OPEN                                                                          OPEN                 |
|DWELL 6                                                                       ROUGH VENT           |
|ROUGH                                                                         VALVE 4              |
|VALVE                                                                         TIMER                |
|RV4                                                                           OPRV4T               |
| O:060                                                                        +-TON-------------+  |
|--] [-------------------------------------------------------------------------+TIMER ON DELAY   +-(EN)-|
|   11                                                                         |TIMER:    T4:159|  |
|[2:58]                                                                        |BASE (SEC):  1.0+-(DN) |
|                                                                              |PRESET:        5|  |
|                                                                              |ACCUM:         0|  |
|                                                                              +-----------------+  |
T4:159.DN - ] [ - File #5 FAULTS -  172
Rung #172
|              DWELL 5                                                                              |
|FAULT         CHAMBER                                                                              |
|DETECT        ROUGH                                                                                |
|ROUGH VENT    VALVE                                                               ROUGH VALVE 4    |
|VALVE 4       OPEN                                                                OPEN FAULT       |
|OPRV4T        RVS8                                                                RV4OPF           |
|  T4:159      I:052                                                                   B3           |
|--] [---------]/[--------------------------------------------------------------------( )----------|
|    DN          15                                                                    132          |
|[171]                                                                                              |
B3/132 - ]/[ - File #5 FAULTS -  179
         -( )- - File #5 FAULTS -  172
ung #173
|OPEN                                                                          CLOSE                |
|DWELL 6                                                                       ROUGH VENT           |
|ROUGH                                                                         VALVE 4              |
|VALVE                                                                         TIMER                |
|RV4                                                                           CLRV4T               |
| O:060                                                                        +-TON-------------+  |
|--]/[-------------------------------------------------------------------------+TIMER ON DELAY   +-(EN)-|
|   11                                                                         |TIMER:    T4:160|  |
|[2:58]                                                                        |BASE (SEC):  1.0+-(DN) |
|                                                                              |PRESET:        5|  |
|                                                                              |ACCUM:         5|  |
|                                                                              +-----------------+  |
T4:160.DN - ] [ - File #5 FAULTS -  174
Rung #174
|FAULT         DWELL 5                                                                              |
|DETECT        CHAMBER                                                                              |
|ROUGH VENT    ROUGH                                                                                |
|VALVE 4       VALVE                                                               ROUGH VALVE 4    |
|CLOSE         CLOSED                                                              CLOSE FAULT      |
|CLRV4T        RVS7                                                                RV4CLF           |
|  T4:160      I:052                                                                   B3           |
 --] [---------]/[--------------------------------------------------------------------( )----------|
|    DN          14                                                                    133          |
|[173]                                                                                              |
B3/133 - ]/[ - File #5 FAULTS -  179
         -( )- - File #5 FAULTS -  174
```

642

```
Rung  #175
|OPEN                                                                        OPEN
|EXLOCK                                                                      ROUGH VENT
|ROUGH                                                                       VALVE 5
|VALVE                                                                       TIMER
|RV5                                                                         OPRV5T
| O:060                                                                      +-TON-----------------+
|-| |------------------------------------------------------------------------+TIMER ON DELAY       +-(EN)-
|  12                                                                        |TIMER:       T4:161|
|[2:340]                                                                     |BASE (SEC):    1.0+-(DN)
|                                                                            |PRESET:          60|
|                                                                            |ACCUM:            0|
|                                                                            +--------------------+
T4:161.DN - -| |- - File #5 FAULTS -  176
Rung  #176
|FAULT        EXLOCK
|DETECT       CHAMBER
|ROUGH VENT   ROUGH
|VALVE 5      VALVE                                                               ROUGH VALVE 5
|OPEN         OPEN                                                                OPEN FAULT
|OPRV5T       RVS10                                                               RV5OPF
|   T4:161      I:052                                                                   B3
|-----| |--------|/|--------------------------------------------------------------------( )----
|     DN          17                                                                    134
|[175]
B3/134 - -|/|- - File #5 FAULTS -  179
         -( )- - File #5 FAULTS -  176
  ng  #177
|OPEN                                                                        CLOSE
|EXLOCK                                                                      ROUGH VENT
|ROUGH                                                                       VALVE 5
|VALVE                                                                       TIMER
|RV5                                                                         CLRV5T
| O:060                                                                      +-TON-----------------+
|-|/|------------------------------------------------------------------------+TIMER ON DELAY       +-(EN)-
|  12                                                                        |TIMER:       T4:162|
|[2:340]                                                                     |BASE (SEC):    1.0+-(DN)
|                                                                            |PRESET:           5|
|                                                                            |ACCUM:            5|
|                                                                            +--------------------+
T4:162.DN - -| |- - File #5 FAULTS -  178
Rung  #178
|FAULT        EXLOCK
|DETECT       CHAMBER
|ROUGH VENT   ROUGH
|VALVE 5      VALVE                                                               ROUGH VALVE 5
|CLOSE        CLOSED                                                              CLOSE FAULT
|CLRV5T       RVS9                                                                RV5CLF
|   T4:162      I:052                                                                   B3
     -| |--------|/|--------------------------------------------------------------------( )----
|     DN          16                                                                    135
|[177]
B3/135 - -|/|- - File #5 FAULTS -  179
         -( )- - File #5 FAULTS -  178
Rung  #179
|             ROUGH
|             VALVE 1
|ROUGH VALVE 1 CLOSE   ROUGH VALVE 2 ROUGH VALVE 2 ROUGH VALVE 3 ROUGH VALVE 3 ROUGH VALVE 4 ROUGH VALVE 4 ROUGH VALVE 5
|OPEN FAULT   FAULT    OPEN FAULT    CLOSE FAULT   OPEN FAULT    CLOSE FAULT   OPEN FAULT    CLOSE FAULT   OPEN FAULT
|RV1OPF       RV1CLF   RV2OPF        RV2CLF        RV3OPF        RV3CLF        RV4OPF        RV4CLF        RV5OPF
|    B3         B3        B3            B3            B3            B3            B3            B3            B3
|---|/|-------|/|-------|/|-----------|/|-----------|/|-----------|/|-----------|/|-----------|/|-----------|/|---
|    126        127       128           129           130           131           132           133           134
>
```

643

```
[160]   [162]   [164]   [166]   [168]   [170]   [172]   [174]   [176]
                                                                ROUGH VENT
                                                ROUGH VALVE 5   VALVE
                                                CLOSE FAULT     NO FAULT
                                                RV5CLF          RVVNF
                                                    B3              B3
                                                ----]/[--------( )----
                                                    135             384
                                                [178]
B3/384 - ]/[ - File #5 FAULTS -  180
       -( )- - File #5 FAULTS -  179
```

Rung #180

```
|ROUGH VENT                                          ROUGH VENT
|VALVE                                               VALVE
|NO FAULT                                            FAULT
|RVVNF                                               RVVF
|    B3                                                  B3
|----]/[---------------------------------------------(L)----
|    384                                                 386
|[179]
B3/386 - ] [ - File #2 MAIN_PRGRM -  625
       -(L)- - File #5 FAULTS -  180
       -(U)- - File #5 FAULTS -  181
```

Rung #181

```
|                                                    ROUGH VENT
|PAUSE                                               VALVE
  SABLE                                              FAULT
|TS12                                                RVVF
|  N7:16                                                 B3
|----] [---------------------------------------------(U)----
|    4                                                   386
|[2:3]
B3/386 - ] [ - File #2 MAIN_PRGRM -  625
       -(L)- - File #5 FAULTS -  180
       -(U)- - File #5 FAULTS -  181
```

Rung #182

```
|MECHANICAL             ROUGHING                     ROUGHING
|PUMP 1     BLOWER 1    SECTION 1                    SECTION 1
|ENABLED    ENABLED     PRESSURE                     TIMER
|MP1        BL1         PS1                          RS1T
|  O:007      O:007       I:002                      +-TON-----------------+
|----] [--------] [---------] [----------------------|TIMER ON DELAY       |-(EN)-
|    00         01          03                       |TIMER:          T4:7 |
|[2:68]     [2:69]                                   |BASE (SEC):     1.0  |-(DN)
|                                                    |PRESET:         60   |
|                                                    |ACCUM:          0    |
|                                                    +---------------------+
T4:7.DN - ] [ - File #5 FAULTS -  183
```

ung #183

```
|FAULT
|DETECT                                              ROUGHING
|ROUGHING                                            SECTION 1
|SECTION 1                                           FAULT
|RS1T                                                RS1F
|  T4:7                                                  B3
|----] [---------------------------------------------( )----
|    DN                                                  438
|[182]
B3/438 - ] [ - File #5 FAULTS -  188
       -( )- - File #5 FAULTS -  183
```

```
Rung #184
|MECHANICAL             ROUGHING                                              ROUGHING            |
|PUMP 2      BLOWER 2   SECTION 2                                             SECTION 2           |
|ENABLED     ENABLED    PRESSURE                                              TIMER               |
|MP2         BL2        PS8                                                   RS2T                |
|  0:027       0:027      I:022                                              +-TON-------------+  |
|---| |---------| |--------| |-----------------------------------------------+|TIMER ON DELAY   |-(EN)-|
|     00         01         05                                                |TIMER:      T4:8|      |
|[2:73]       [2:74]                                                          |BASE (SEC):  1.0|-(DN)  |
|                                                                             |PRESET:       60|      |
|                                                                             |ACCUM:         0|      |
|                                                                             +-----------------+      |
T4:8.DN - -| |- - File #5 FAULTS -  185
Rung #185
|FAULT                                                                                              |
|DETECT                                                                          ROUGHING           |
|ROUGHING                                                                        SECTION 2          |
|SECTION 2                                                                       FAULT              |
|RS2T                                                                            RS2F               |
|  T4:8                                                                            B3               |
|---| |------------------------------------------------------------------------------( )---------|
|     DN                                                                           439              |
|[184]
B3/439 - -| |- - File #5 FAULTS -  188
         -( )- - File #5 FAULTS -  185
Rung #186
|MECHANICAL             ROUGHING                                              ROUGHING            |
   MP 3      BLOWER 3   SECTION 3                                             SECTION 3           |
|ENABLED     ENABLED    PRESSURE                                              TIMER               |
|MP3         BL3        PS7                                                   RS3T                |
|  0:057       0:057      I:052                                              +-TON-------------+  |
|---| |---------| |--------| |-----------------------------------------------+|TIMER ON DELAY   |-(EN)-|
|     00         01         05                                                |TIMER:      T4:9|      |
|[2:78]       [2:79]                                                          |BASE (SEC):  1.0|-(DN)  |
|                                                                             |PRESET:       60|      |
|                                                                             |ACCUM:         0|      |
|                                                                             +-----------------+      |
T4:9.DN - -| |- - File #5 FAULTS -  187
Rung #187
|FAULT                                                                                              |
|DETECT                                                                          ROUGHING           |
|ROUGHING                                                                        SECTION 3          |
|SECTION 3                                                                       FAULT              |
|RS3T                                                                            RS3F               |
|  T4:9                                                                            B3               |
|---| |------------------------------------------------------------------------------( )---------|
|     DN                                                                           440              |
|[186]
B3/440 - -| |- - File #5 FAULTS -  188
         -( )- - File #5 FAULTS -  187
```

Rung #188

```
|  ROUGHING                                                    |
|  SECTION 1                                        MECHANICAL |
|  FAULT                                        PUMP FAILURE   |
|  RS1F                                         MECH_P_FAIL    |
|     B3                                                 B3    |
|-+---] [---+-----------------------------------------------(L)---|
| |   438   |                                            385   |
| |[183]    |                                                  |
| |         | B3/385 - ] [ - File #2 MAIN_PRGRM - 626          |
| |         |         -(U)- - File #5 FAULTS - 189             |
| |ROUGHING |                                                  |
| |SECTION 2|                                                  |
| |FAULT    |                                                  |
| |RS2F     |                                                  |
| |   B3    |                                                  |
| |---] [---|                                                  |
| |   439   |                                                  |
| |[185]    |                                                  |
| |ROUGHING |                                                  |
| |SECTION 3|                                                  |
| |FAULT    |                                                  |
| |RS3F     |                                                  |
| |   B3    |                                                  |
| +---] [---+                                                  |
|     440                                                      |
   [187]
```

ng #189

```
|PAUSE                                              MECHANICAL |
|DISABLE                                        PUMP FAILURE   |
|TS12                                           MECH_P_FAIL    |
| N7:16                                                  B3    |
|---] [-------------------------------------------------(U)----|
|    4                                                  385    |
|[2:3]                                                         |
B3/385 - ] [ - File #2 MAIN_PRGRM -  626
        -(L)- - File #5 FAULTS -  188
        -(U)- - File #5 FAULTS -  189
```

Rung #190

```
|                                                   HEATER     |
| HEATER                                        SHIELD H2O     |
| SHIELD H2O                                    FLOW           |
| FLOW                                          GROUP 1        |
| SWITCH 1                                      FAULT          |
| HSFS1                                         HSFG1F         |
|    I:006                                               B3    |
|-+---]/[---+-----------------------------------------------( )---|
| |    10   |                                            216   |
| |HEATER   | B3/216 - ] [ - File #5 FAULTS - 199              |
| |SHIELD H2O|        -]/[- - File #2 MAIN_PRGRM - 213         |
| |FLOW     |                                                  |
| |SWITCH 2 |                                                  |
| |HSFS2    |                                                  |
| |  I:006  |                                                  |
| +---]/[---+                                                  |
|     11                                                       |
```

```
Rung #191
|                                                                  HEATER      |
| HEATER                                                           SHIELD H2O  |
| SHIELD H2O                                                       FLOW        |
| FLOW                                                             GROUP 2     |
| SWITCH 3                                                         FAULT       |
| HSFS3                                                            HSFG2F      |
|    I:006                                                             B3      |
|-+---|/|---+--------------------------------------------------------( )------|
| |    12   |                                                         217      |
| |HEATER   | B3/217 - -| |- - File #5 FAULTS - 199                            |
| |SHIELD H2O|         -|/|- - File #2 MAIN_PRGRM - 226                       |
| |FLOW     |                                                                  |
| |SWITCH 4 |                                                                  |
| |HSFS4    |                                                                  |
| |  I:006  |                                                                  |
| +---|/|---+                                                                  |
|      13                                                                      |
Rung #192
|                                                                  HEATER      |
| HEATER                                                           SHIELD H2O  |
| SHIELD H2O                                                       FLOW        |
| FLOW                                                             GROUP 3     |
| SWITCH 5                                                         FAULT       |
| HSFS5                                                            HSFG3F      |
|    I:023                                                             B3      |
|-+---|/|---+-[AFI]--------------------------------------------------( )------|
| |    16   |                                                         218      |
| |HEATER   | B3/218 - -| |- - File #5 FAULTS - 199                            |
| |SHIELD H2O|                                                                 |
| |FLOW     |                                                                  |
| |SWITCH 6 |                                                                  |
| |HSFS6    |                                                                  |
| |  I:023  |                                                                  |
| +---|/|---+                                                                  |
|      17                                                                      |
```

```
Rung #193
|                                                                  CATHODE   |
|                                                                  H2O FLOW  |
| CATHODE                                                          SWITCH    |
| WATER FLOW                                                       GROUP 1   |
| SWITCH 1                                                         FAULT     |
| CHR1A                                                            CWFSG1F   |
|    I:026                                                            B3     |
|-+---|/|----+--------------------------------------------------------( )----|
| |    10    |                                                        136    |
| |          | B3/136 - -| |- - File #5 FAULTS - 202                         |
| |CATHODE   |                                                               |
| |WATER FLOW|                                                               |
| |SWITCH 2  |                                                               |
| |CHR2A     |                                                               |
| |  I:026   |                                                               |
| |---|/|----|                                                               |
| |    11    |                                                               |
| |CATHODE   |                                                               |
| |WATER FLOW|                                                               |
| |SWITCH 3  |                                                               |
| |CHR3A     |                                                               |
| |  I:026   |                                                               |
| |---|/|----|                                                               |
| |    12    |                                                               |
| |CATHODE   |                                                               |
| |WATER FLOW|                                                               |
|  SWITCH 4  |                                                               |
| |CHR4A     |                                                               |
| |  I:026   |                                                               |
| |---|/|----|                                                               |
| |    13    |                                                               |
| |CATHODE   |                                                               |
| |SHIELD H2O|                                                               |
| |FLOW      |                                                               |
| |SWITCH 1  |                                                               |
| |CSFS1     |                                                               |
| |  I:025   |                                                               |
| |---|/|----|                                                               |
| |    04    |                                                               |
| |CATHODE   |                                                               |
| |SHIELD H2O|                                                               |
| |FLOW      |                                                               |
| |SWITCH 2  |                                                               |
| |CSFS2     |                                                               |
| |  I:025   |                                                               |
| +---|/|----+                                                               |
|      05                                                                    |
```

Rung #194

```
 WATER FLOW                                                  CATHODE
 SWITCH 5                                                    H2O FLOW
 CHR1B                                                       SWITCH
   I:026                                                     GROUP 2
---|/|-------------------------------------------------------FAULT
    14                                                       CWFSG2F
                                                               B3
 CATHODE          B3/137 - -| |- - File #5 FAULTS - 202     --( )--
 WATER FLOW                                                   137
 SWITCH 6
 CHR2B
   I:026
---|/|---
    15
 CATHODE
 WATER FLOW
 SWITCH 7
 CHR3B
   I:026
---|/|---
    16
 CATHODE
 WATER FLOW
 SWITCH 8
 CHR4B
   I:026
---|/|---
    17
```

Rung #195

```
CATHODE                                                  CATHODE
WATER FLOW                                               H2O FLOW
SWITCH 9                                                 SWITCH
WFS9                                                     GROUP 3
 I:042                                                   FAULT
                                                         CWFSG3F
                                                           B3
--]/[---------------------------------------------------( )--
  10                                                       138
       B3/138 - ] [ - File #5 FAULTS - 202
CATHODE
WATER FLOW
SWITCH 10
WFS10
 I:042
--]/[--
  11
CATHODE
WATER FLOW
SWITCH 11
WFS11
 I:042
--]/[--
  12
CATHODE
WATER FLOW
SWITCH 12
WFS12
 I:042
--]/[--
  13
CATHODE
SHIELD H2O
FLOW
SWITCH 9
CSFS9
 I:041
--]/[--
  04
CATHODE
SHIELD H2O
FLOW
SWITCH 10
CSFS10
 I:041
--]/[--
  05
```

```
Rung #196
|                                                                         CATHODE   |
|                                                                         H2O FLOW  |
| CATHODE                                                                 SWITCH    |
| WATER FLOW                                                              GROUP 4   |
| SWITCH 13                                                               FAULT     |
| WFS13                                                                   CWFSG4F   |
|    I:042                                                                  B3      |
|----]/[---+-------------------------------------------------------------( )-------|
|  |  14   |                                                             139       |
|  |       | B3/139 - ] [ - File #5 FAULTS - 202                                   |
|  |CATHODE|                                                                       |
|  |WATER FLOW                                                                     |
|  |SWITCH 14                                                                      |
|  |WFS14  |                                                                       |
|  |  I:042|                                                                       |
|  |---]/[-|                                                                       |
|  |  15   |                                                                       |
|  |CATHODE|                                                                       |
|  |WATER FLOW                                                                     |
|  |SWITCH 15                                                                      |
|  |WFS15  |                                                                       |
|  |  I:042|                                                                       |
|  |---]/[-|                                                                       |
|  |  16   |                                                                       |
|  |CATHODE|                                                                       |
|  |WATER FLOW                                                                     |
|    ITCH 16                                                                       |
|  |WFS16  |                                                                       |
|  |  I:042|                                                                       |
|  +---]/[-+                                                                       |
|     17                                                                          |
```

Rung #197

```
|                                                                  CATHODE   |
|                                                                  H20 FLOW  |
| CATHODE                                                          SWITCH    |
| WATER FLOW                                                       GROUP 5   |
| SWITCH 17                                                        FAULT     |
| WFS17                                                            CWFSG5F   |
|    I:056                                                            B3     |
|-+---|/|---+-------------------------------------------------------( )------|
| |   10    |                                                        140     |
| |         | B3/140 - -| |- - File #5 FAULTS - 202                         |
| |CATHODE  |                                                                |
| |WATER FLOW                                                                |
| |SWITCH 18|                                                                |
| |WFS18    |                                                                |
| |  I:056  |                                                                |
| |---|/|---|                                                                |
| |   11    |                                                                |
| |CATHODE  |                                                                |
| |WATER FLOW                                                                |
| |SWITCH 19|                                                                |
| |WFS19    |                                                                |
| |  I:056  |                                                                |
| |---|/|---|                                                                |
| |   12    |                                                                |
| |CATHODE  |                                                                |
| |WATER FLOW                                                                |
| |SWITCH 20|                                                                |
| |WFS20    |                                                                |
| |  I:056  |                                                                |
| |---|/|---|                                                                |
| |   13    |                                                                |
| |CATHODE  |                                                                |
| |SHIELD   |                                                                |
| |H20 FLOW |                                                                |
| |SWITCH 17|                                                                |
| |CSFS17   |                                                                |
| |  I:055  |                                                                |
| |---|/|---|                                                                |
| |   04    |                                                                |
| |CATHODE  |                                                                |
| |SHIELD   |                                                                |
| |H20 FLOW |                                                                |
| |SWITCH 18|                                                                |
| |CSFS18   |                                                                |
| |  I:055  |                                                                |
| +---|/|---+                                                                |
|     05                                                                     |
```

652

```
Rung #198                                                                  CATHODE
                                                                           H2O FLOW
                                                                           SWITCH
  CATHODE                                                                  GROUP 6
  WATER FLOW                                                               FAULT
  SWITCH 21                                                                CWFSG6F
  WFS21                                                                      B3
     I:056
|----]/[----+--------------------------------------------------------------( )----|
     14     |                                                              141
            | B3/141 - ] [ - File #5 FAULTS - 202
 | CATHODE  |
 | WATER FLOW
 | SWITCH 22|
 | WFS22    |
 |   I:056  |
 |----]/[---|
 |    15    |
 | CATHODE  |
 | WATER FLOW
 | SWITCH 23|
 | WFS23    |
 |   I:056  |
 |----]/[---|
 |    16    |
 | CATHODE  |
 | WATER FLOW
 | SWITCH 24|
 | WFS24    |
 |   I:056  |
 +----]/[---+
      17
```

```
Rung #199
| HEATER
| SHIELD H20
| FLOW                                                         HEATER SHIELD
| GROUP 1       PAUSE                                          FLOW FAULT
| FAULT         DISABLE                                        TIMER
| HSFG1F        TS12                                           HSFFTMR
|      B3        N7:16                                         +-TON-------------+
|--+---] [---+----]/[------------------------------------------|TIMER ON DELAY   |-(EN)-
|  |   216   |     4                                           |TIMER:     T4:93 |
|  |[190]    |  [2:3]                                          |BASE (SEC):  1.0 |-(DN)
|  |         |                                                 |PRESET:       20 |
|  |HEATER   |                                                 |ACCUM:         0 |
|  |SHIELD H20                                                 +-----------------+
|  |FLOW     |
|  |GROUP 2  |
|  |FAULT    |
|  |HSFG2F   |
|  |    B3   |
|  |---] [---|
|  |   217   |
|  |[191]    |
|  |HEATER   |
|  |SHIELD H20
|  |FLOW     |
|  |GROUP 3  |
|  |FAULT    |
|  |HSFG3F   |
|  |    B3   |
|  +---] [---+
|      218
|  [192]
T4:93.DN - ] [ - File #2 MAIN_PRGRM - 223
                 File #5 FAULTS - 200
T4:93.TT - ] [ - File #2 MAIN_PRGRM - 718
Rung #200
|                                                              HEATER
|                                                              SHIELD H20
|                                                              FLOW FAULT
|                                                              HSFF
|HSFFTMR                                                         B3
| T4:93
|---] [----------------------------------------------------------(L)---
|   DN                                                           219
|[199]
B3/219 - ] [ - File #2 MAIN_PRGRM - 625
       -(L)- - File #5 FAULTS - 200
       -(U)- - File #5 FAULTS - 201
Rung #201
|                                                              HEATER
 PAUSE                                                         SHIELD H20
|DISABLE                                                       FLOW FAULT
|TS12                                                          HSFF
| N7:16                                                          B3
|---] [----------------------------------------------------------(U)---
|   4                                                            219
|[2:3]
B3/219 - ] [ - File #2 MAIN_PRGRM - 625
       -(L)- - File #5 FAULTS - 200
       -(U)- - File #5 FAULTS - 201
```

654

Rung #202

```
| CATHODE
| H2O FLOW
| SWITCH                                                                CATHODE FLOW
| GROUP 1      PAUSE                                                    FAULT TIMER
| FAULT        DISABLE                                                  CFFTMR
| CWFSG1F      TS12                                                     +-TON-----------------+
|    B3        N7:16                                                    |                     |
+-+--] [--+-----]/[-----------------------------------------------------+TIMER ON DELAY       +-(EN)-
| |  136  |      4                                                      |TIMER:          T4:94|
| |[193]  |    [2:3]                                                  |BASE (SEC):       1.0+-(DN)
| |       |                                                             |PRESET:            20|
| |CATHODE|                                                             |ACCUM:              0|
| |H2O FLOW                                                             +---------------------+
| |SWITCH |
| |GROUP 2|
| |FAULT  |
| |CWFSG2F|
| |   B3  |
| +--] [--+
| |  137  |
| |[194]  |
| |CATHODE|
| |H2O FLOW
| |SWITCH |
| |GROUP 3|
| |FAULT  |
|  WFSG3F |
| |   B3  |
| +--] [--+
| |  138  |
| |[195]  |
| |CATHODE|
| |H2O FLOW
| |SWITCH |
| |GROUP 4|
| |FAULT  |
| |CWFSG4F|
| |   B3  |
| +--] [--+
| |  139  |
| |[196]  |
| |CATHODE|
| |H2O FLOW
| |SWITCH |
| |GROUP 5|
| |FAULT  |
| |CWFSG5F|
| |   B3  |
|   --] [--+
| |  140  |
| |[197]  |
| |CATHODE|
| |H2O FLOW
| |SWITCH |
| |GROUP 6|
| |FAULT  |
| |CWFSG6F|
| |   B3  |
| +--] [--+
|    141
|  [198]
```

```
T4:94.DN - -| |- - File #5 FAULTS -  203
T4:94.TT - -| |- - File #2 MAIN_PRGRM -  718
Rung #203
|                                                              CATHODE  |
|                                                              H2O FLOW |
|                                                              FAULT    |
|CFFTMR                                                        CWFF     |
| T4:94                                                          B3     |
|-| |------------------------------------------------------------(L)----|
|  DN                                                           220     |
|[202]                                                                  |
B3/220 - -| |- - File #2 MAIN_PRGRM -  625
         -(L)- - File #5 FAULTS -  203
         -(U)- - File #5 FAULTS -  204
Rung #204
|                                                              CATHODE  |
|PAUSE                                                         H2O FLOW |
|DISABLE                                                       FAULT    |
|TS12                                                          CWFF     |
| N7:16                                                          B3     |
|-| |------------------------------------------------------------(U)----|
|  4                                                            220     |
|[2:3]                                                                  |
B3/220 - -| |- - File #2 MAIN_PRGRM -  625
         -(L)- - File #5 FAULTS -  203
         -(U)- - File #5 FAULTS -  204
Rung #205
   WI      PIRANI    PIRINI    PIRINI    PIRINI    PIRINI    PIRINI    PIRINI           PIRINI   |
|GUAGE 1   GUAGE 2   GUAGE 3   GUAGE 4   GUAGE 5   GUAGE 6   GUAGE 7   GUAGE 8          GUAGE NO |
|NO FAULT  NO FAULT  NO FAULT  NO FAULT  NO FAULT  NO FAULT  NO FAULT  NO FAULT         FAULT    |
|PGNF1     PGNF2     PGNF3     PGNF4     PGNF5     PGNF6     PGNF7     PGNF8            PGNF     |
| I:004     I:004     I:024     I:024     I:040     I:040     I:054     I:054             B3     |
|-| |-------| |-------| |-------| |-------| |-------| |-------| |-------| |---------------( )----|
|  14        15        14        15        14        15        14        15              465     |
B3/465 - -| |- - File #2 MAIN_PRGRM -  23
         -|/|- - File #2 MAIN_PRGRM -  22,624
         -( )- - File #5 FAULTS -  205
Rung #206
|CHAMBER  CHAMBER  CHAMBER  CHAMBER   CHAMBER   CHAMBER              ALL CHAMBER    |
|COVER 5  COVER 6  COVER 9  COVER 10  COVER 11  COVER 12             COVERS CLOSED  |
|CC5      CC6      CC9      CC10      CC11      CC12                 ACCC           |
| I:025    I:025    I:041    I:041     I:055     I:055                 B3          |
|-| |------| |------| |------| |-------| |-------| |--------------------( )---------|
|  00       01       00       01        00        01                  315          |
B3/315 - -|/|- - File #5 FAULTS -  207
         -( )- - File #5 FAULTS -  206
Rung #207
|                                                              CHAMBER  |
|ALL CHAMBER                                                   COVERS   |
  ERS CLOSED                                                   CLOSED   |
|ACCC                                                          CCC      |
|      B3                                                        B3     |
|-----|/|--------------------------------------------------------(L)----|
|     315                                                       467     |
|[206]                                                                  |
B3/467 - -| |- - File #2 MAIN_PRGRM -  626
         -(L)- - File #5 FAULTS -  207
         -(U)- - File #5 FAULTS -  208
```

656

```
Rung #208
|                                                                      CHAMBER |
|PAUSE                                                                 COVERS  |
|DISABLE                                                               CLOSED  |
|TS12                                                                  CCC     |
|  N7:16                                                                 B3    |
|---] [---------------------------------------------------------------(U)------|
|    4                                                                  467    |
|[2:3]                                                                         |
B3/467 - ] [ - - File #2 MAIN_PRGRM -  626
         -(L)- - File #5 FAULTS -  207
         -(U)- - File #5 FAULTS -  208
Rung #209
|                                                          RETURN TO MAIN      |
|                                                          FROM_CRYO_RGN       |
|                                                          +-RET----------+    |
|---------------------------------------------------------|RETURN ()      |----|
|                                                          +--------------+    |
Rung #210
|----------------------------------------------------------------------[END]---|
```

Rung #000

Description	Address	Bit	Ref
MECHANICAL PUMP 1 ENABLED MP1	0:007	00	[2:68]
BLOWER 1 ENABLED BL1	0:007	01	[2:69]
MECHANICAL PUMP 2 ENABLED MP2	0:027	00	[2:73]
BLOWER 2 ENABLED BL2	0:027	01	[2:74]
MECHANICAL PUMP 3 ENABLED MP3	0:057	00	[2:78]
BLOWER 3 ENABLED BL3	0:057	01	[2:79]
OPEN LOAD LOCK ROUGH VALVE RV1	0:010	11	[2:167]
OPEN DWELL 2 ROUGH VALVE RV2	0:030	11	[2:56]
OPEN DWELL 4 ROUGH VALVE RV3	0:044	11	[2:57]
OPEN DWELL 6 ROUGH VALVE RV4	0:060	11	[2:58]
OPEN EXLOCK ROUGH VALVE RV5	0:060	12	[2:340]
OPEN LOAD LOCK CHAMBER VENT VALVE CV1	0:007	16	[2:173]
OPEN DWELL 2 VENT VALVE CV2	0:007	17	[2:396]
OPEN DWELL 3 VENT VALVE CV3	0:027	16	[2:401]
OPEN DWELL 5 VENT VALVE CV4	0:043	16	[2:403]
OPEN EXLOCK CHAMBER VENT VALVE CV5	0:057	16	[2:346]
( ) output	B3	9	

B3/9 - -( )- - File #6 TECH_RUNGS - 0,1

Rung #001

Description	Address	Bit	Ref
ROUGHING SECTION 1 PRESSURE PS1	I:002	03	
LLOCK CHAMBER PRESSUR AT ATMOSPHERE PS2	I:002	04	
DWELL 1 CHAMBER PRESSUR AT ATMOSPHERE PS3	I:002	05	
DWELL 3 CHAMBER PRESSUR AT ATMOSPHERE PS4	I:022	04	
DWELL 5 CHAMBER PRESSUR AT ATMOSPHERE PS5	I:036	04	
OPEN PUMP 1 VENT VALVE PV1	0:007	02	[2:59]
OPEN PUMP 2 VENT VALVE PV2	0:027	02	[2:60]
OPEN PUMP 3 VENT VALVE PV3	0:057	02	[2:61]
( ) output	B3	9	

B3/9 - -( )- - File #6 TECH_RUNGS - 0

Rung #002

Description	Address	Bit	Ref
DOOR CLOSE SOLENOID 1 ENABLE DRCL1	0:011	00	[2:183]
OPEN DOOR 1 DROP1	0:011	01	[2:181]
DOOR CLOSE SOLENOID 2 ENABLE DRCL2	0:011	02	[2:202]
OPEN DOOR SOLENOID 2 ENABLE DROP2	0:011	03	[2:200]
CLOSE DOOR 3 DRCL3	0:011	04	[2:229]
DOOR OPEN SOLENOID 3 ENABLE DROP3	0:011	05	[2:216]
DOOR CLOSE SOLENOID 4 ENABLE DRCL4	0:011	06	[2:408]
DOOR OPEN SOLENOID 4 ENABLE DROP4	0:011	07	[2:415]
DOOR CLOSE SOLENOID 5 ENABLE DRCL5	0:031	00	[2:414]
DOOR OPEN SOLENOID 5 ENABLE DROP5	0:031	01	[2:46]
DOOR CLOSE SOLENOID 6 ENABLE DRCL6	0:031	02	[2:420]
DOOR OPEN SOLENOID 6 ENABLE DROP6	0:031	03	[2:47]
DUMMY TEMP5 ( ) output	B3	5	

Rung #003

Description	Address	Bit	Ref
DOOR CLOSE SOLENOID 7 ENABLE DRCL7	0:045	00	[2:422]
DOOR OPEN SOLENOID 7 ENABLE DROP7	0:045	01	[2:48]
DOOR CLOSE SOLENOID 8 ENABLE DRCL8	0:045	02	[2:427]
DOOR OPEN SOLENOID 8 ENABLE DROP8	0:045	03	[2:49]
CLOSE DOOR 9 SOLENOID ENABLE DRCL9	0:061	00	[2:329]
DOOR OPEN SOLENOID 9 ENABLE DROP9	0:061	01	[2:325]
CLOSE DOOR 10 ENABLE DRCL10	0:061	02	[2:335]
DOOR OPEN SOLENOID 10 ENABLE DROP10	0:061	03	[2:326]
CLOSE DOOR 11 DRCL11	0:061	04	[2:337]
DOOR OPEN SOLENOID 11 ENABLE DROP11	0:061	05	[2:327]
DOOR CLOSE SOLENOID12 ENABLE DRCL12	0:061	06	[2:353]
DUMMY TEMP6 ( ) output	B3	6	

```
Rung #004
|DOOR 1   DOOR 2   DOOR 3   DOOR 4   DOOR 5                                  DUMMY
|OPEN     OPEN     OPEN     OPEN     OPEN                                    DUMMY
|DROP1S   DROP2S   DROP3S   DROP4S   DROP5S                                  B3
| I:006   I:006    I:006    I:006    I:026
|-| |------| |------| |------| |------| |---------------------------------( )-|
|  01       03       05       07       01                                  30
B3/30 - -( )- - File #6 TECH_RUNGS - 4,8,9,10,11,12,13
Rung #005
|DOOR 1  DOOR 2  DOOR 3  DOOR 4  DOOR 5  DOOR 6  DOOR 7  DOOR 8  DOOR 9  DOOR 10  DOOR 11  DOOR 12      TEMP
|CLOSED  CLOSED  CLOSED  CLOSED  CLOSED  CLOSED  CLOSED  CLOSED  CLOSED  CLOSED   CLOSED   CLOSED       DUMMY_97
|DRCL1S  DRCL2S  DRCL3S  DRCL4S  DRCL5S  DRCL6S  DRCL7S  DRCL8S  DRCL9S  DRCL10S  DRCL11S  DRCL12S      B3
| I:006  I:006   I:006   I:006   I:026   I:026   I:042   I:042   I:056   I:056    I:056    I:056
|-| |-----| |-----| |-----| |-----| |-----| |-----| |-----| |-----| |-----| |------| |------| |--------( )-|
|  00      02      04      06      00      02      00      02      00      02       04       06          97
Rung #006
|           CRYO GATE  CRYO GATE  CRYO GATE  CRYO GATE  CRYO GATE  CRYO GATE  CRYO GATE  CRYO GATE  CRYO GATE  CRYO GATE
|CRYO GATE  SOLENOID 1 SOLENOID 2 SOLENOID 1 SOLENOID 2 SOLENOID 1 SOLENOID 2 SOLENOID 1 SOLENOID 2 SOLENOID 1 SOLENOID 2
|HEATER 1   HEATER 2   HEATER 2   DWELL 1    DWELL 1    DWELL 2    DWELL 2    HEATER 2   HEATER 2   DWELL 3    DWELL 3
|CHAMBER    CHAMBER    CHAMBER    CHAMBER    CHAMBER    CHAMBER    CHAMBER    CHAMBER    CHAMBER    CHAMBER    CHAMBER
|HV1        HV2_1      HV2_2      HV3_1      HV3_2      HV4_1      HV4_2      HV5_1      HV5_2      HV6_1      HV6_2
|  0:011      0:011      0:011      0:011      0:011      0:031      0:031      0:031      0:031      0:031      0:031
|---| |--------| |--------| |--------| |--------| |--------| |--------| |--------| |--------| |--------| |--------| |--
|    11         13         14         15         16         11         12         13         14         15         16
|[2:115]    [2:117]    [2:118]    [2:119]    [2:120]    [2:121]    [2:122]    [2:123]    [2:124]    [2:125]    [2:126]
             CRYO GATE  CHROME     CHROME     MAGNETIC   MAGNETIC   CARBON     CARBON                |
             SOLENOID 1 HI POWER   HI POWER   HI POWER   HI POWER   HI POWER   HI POWER              |
             DWELL 4    SUPPLY 1   SUPPLY 3   SUPPLY 1   SUPPLY 3   SUPPLY 1   SUPPLY 3              |
             CHAMBER    OUTPUT     OUTPUT     OUTPUT     OUTPUT     OUTPUT     OUTPUT      DUMMY     |
             HV7_1      CHRPS1     CHRPS3     MAGPS1     MAGPS3     CARPS1     CARPS3      TEMP7     |
               0:045      0:033      0:033      0:033      0:063      0:063      0:063     B3        |
           ------| |--------| |--------| |--------| |--------| |--------| |--------| |--------( )---|
                  11         10         12         14         10         12         14        7      |
             [2:127]    [2:236]    [2:242]    [2:268]    [2:274]    [2:299]    [2:300]               |
B3/7 - -( )- - File #6 TECH_RUNGS - 6,7
Rung #007
|CRYO GATE  CRYO GATE  CRYO GATE  CRYO GATE  CRYO GATE  CRYO GATE  CRYO GATE  CRYO GATE  CRYO GATE  CRYO GATE
|SOLENOID 2 SOLENOID 1 SOLENOID 2 SOLENOID 1 SOLENOID 2 SOLENOID 1 SOLENOID 2 SOLENOID 1 SOLENOID 2 SOLENOID 1
|DWELL 4    BUFFER 3   BUFFER 3   DWELL 5    DWELL 5    DWELL 6    DWELL 6    BUFFER 4   BUFFER 4   EXBUFFER
|CHAMBER    CHAMBER    CHAMBER    CHAMBER    CHAMBER    CHAMBER    CHAMBER    CHAMBER    CHAMBER    CHAMBER
|HV7_2      HV8_1      HV8_2      HV9_1      HV9_2      HV10_1     HV10_2     HV11_1     HV11_2     HV12_1
|  0:045      0:045      0:045      0:045      0:045      0:061      0:061      0:061      0:061      0:061
|---| |--------| |--------| |--------| |--------| |--------| |--------| |--------| |--------| |--------| |----
|    12         13         14         15         16         11         12         13         14         15
|[2:128]    [2:129]    [2:130]    [2:131]    [2:132]    [2:133]    [2:134]    [2:135]    [2:136]    [2:137]
                                                           OPEN        OPEN        OPEN        OPEN         |CRYO GA
                                                           CAPACITANC  CAPACITANC  CAPACITANC  CAPACITANC   |SOLENOI
           CRYO GATE  OPEN RGA   OPEN RGA   OPEN RGA   OPEN RGA   MANOMETER   MANOMETER   MANOMETER   MANOMETER    |DWELL 4
           SOLENOID 2 ISOLATION  ISOLATION  ISOLATION  ISOLATION  ISOLATION   ISOLATION   ISOLATION   ISOLATION    |CHAMBER
           EXBUFFER   VALVE 1    VALVE 2    VALVE 3    VALVE 4    VALVE 1     VALVE 2     VALVE 3     VALVE 4      |HV7_2
           CHAMBER    RGAV1      RGAV2      RGAV3      RGAV4      CMV1        CMV2        CMV3        CMV4         |  0:04
           HV12_2
             0:061      0:010      0:030      0:044      0:060      0:010       0:030       0:044       0:060      |---| |
           -----| |--------| |--------| |--------| |--------| |---------| |---------| |---------| |---------| |--|     12
                 16         13         13         13         13          06          06          06          06   |[2:128]
           [2:138]    [2:371]    [2:372]    [2:373]    [2:374]    [2:375]     [2:376]     [2:377]     [2:378]      |
B3/7 - -( )- - File #6 TECH_RUNGS - 6
```

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Rung #008

Description	Tag	Address	Bit
HEATER 1 CHAMBER GATE VALVE CLOSE	HV1S1	I:002	06
HEATER 2 CHAMBER GATE VALVE CLOSE	HV2S1	I:004	00
DWELL 1 CHAMBER GATE VALVE CLOSED	HV3S1	I:004	03
DWELL 2 CHAMBER GATE VALVE CLOSED	HV4S1	I:022	06
HEATER 3 CHAMBER GATE VALVE CLOSED	HV5S1	I:024	00
DWELL 3 CHAMBER GATE VALVE CLOSED	HV6S1	I:024	03
DWELL 4 CHAMBER GATE VALVE CLOSED	HV7S1	I:036	06
BUFFER 3 CHAMBER GATE VALVE CLOSED	HV8S1	I:040	00
DWELL 5 CHAMBER GATE VALVE CLOSED	HV9S1	I:040	03
DWELL 6 CHAMBER GATE VALVE CLOSED	HV10S1	I:052	06
BUFFER 4 CHAMBER GATE VALVE CLOSED	HV11S1	I:054	00
EXITLOCK CHAMBER GATE VALVE CLOSED	HV12S1	I:054	03
DUMMY -( )-	DUMMY	B3	30

B3/30 - -( )- - File #6 TECH_RUNGS - 4,9,10,11,12,13

Rung #009

Description	Tag	Address	Bit
HEATER 2 CHAMBER GATE VALVE THROTTLED	HV2S2	I:004	01
DWELL 1 CHAMBER GATE VALVE THROTTLED	HV3S2	I:004	04
DWELL 2 CHAMBER GATE VALVE THROTTLED	HV4S2	I:022	07
HEATER 3 CHAMBER GATE VALVE THROTTLED	HV5S2	I:024	01
DWELL 3 CHAMBER GATE VALVE THROTTLED	HV6S2	I:024	04
DWELL 4 CHAMBER GATE VALVE THROTTLED	HV7S2	I:036	07
BUFFER 3 CHAMBER GATE VALVE THROTTLED	HV8S2	I:040	01
DWELL 5 CHAMBER GATE VALVE THROTTLED	HV9S2	I:040	04
DWELL 6 CHAMBER GATE VALVE THROTTLED	HV10S2	I:052	07
BUFFER 4 CHAMBER GATE VALVE THROTTLED	HV11S2	I:054	01
EXIT BUFFER GATE VALVE THROTTLED	HV12S2	I:054	04
DUMMY -( )-	DUMMY	B3	30

B3/30 - -( )- - File #6 TECH_RUNGS - 4,8,10,11,12,13

Rung #010

Description	Tag	Address	Bit
HEATER 1 CHAMBER GATE VALVE OPEN	HV1S3	I:002	10
HEATER 2 CHAMBER GATE VALVE OPEN	HV2S3	I:004	02
DWELL 1 CHAMBER GATE VALVE OPEN	HV3S3	I:004	05
DWELL 2 CHAMBER GATE VALVE OPEN	HV4S3	I:022	10
HEATER 3 CHAMBER GATE VALVE OPEN	HV5S3	I:024	02
DWELL 3 CHAMBER GATE VALVE OPEN	HV6S3	I:024	05
DWELL 4 CHAMBER GATE VALVE OPEN	HV7S3	I:036	10
BUFFER 3 CHAMBER GATE VALVE OPEN	HV8S3	I:040	02
DWELL 5 CHAMBER GATE VALVE OPEN	HV9S3	I:040	05
DWELL 6 CHAMBER GATE VALVE OPEN	HV10S3	I:052	10
BUFFER 4 CHAMBER GATE VALVE OPEN	HV11S3	I:054	02
EXIT BUFFER GATE VALVE OPEN	HV12S3	I:054	05
DUMMY -( )-	DUMMY	B3	30

B3/30 - -( )- - File #6 TECH_RUNGS - 4,8,9,11,12,13

Rung #011

Description	Tag	Address	Bit
PALLET DETECTED LEFT SIDE ENTRANCE	SEN1	I:003	00
PALLET DETECTED CENTER ENTRANCE	SEN2	I:003	01
PALLET DETECTED RIGHT SIDE ENTRANCE	SEN3	I:003	02
PALLET DETECTED LEFT SIDE LOADLOCK	SEN4	I:003	03
PALLET DETECTED CENTER LOADLOCK	SEN5	I:003	04
PALLET DETECTED RIGHT SIDE LOADLOCK	SEN6	I:003	05
PALLET DETECTED LEFT SIDE HEATER 1	SEN7	I:003	06
PALLET DETECTED CENTER HEATER 1	SEN8	I:003	07
PALLET DETECTED RIGHT SIDE HEATER 1	SEN9	I:003	10
PALLET DETECTED LEFT SIDE HEATER 2	SEN10	I:003	11
PALLET DETECTED CENTER BUFFER 1	SEN11	I:003	12

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PALLET DETECTED RIGHT SIDE HEATER 2 SEN12	PALLET DETECTED LEFT SIDE DWELL 1 SEN13	PALLLET DETECTED CENTER DWELL 1 SEN14	PALLET DETECTED RIGHT SIDE DWELL 1 SEN15	PALLET DETECTED LEFT SIDE CHROME SEN16	PALLET DETECTED CENTER CHROME SEN17	PALLET DETECTED RIGHT SIDE CHROME SEN18	DUMMY DUMMY
I:003	I:003	I:003	I:003	I:023	I:023	I:023	B3
13	14	15	16	00	01	02	30

B3/30 - -( )- - File #6 TECH_RUNGS - 4,8,9,10,12,13

Rung #012

PALLET DETECTED LEFT SIDE DWELL 2 SEN19	PALLET DETECTED CENTER DWELL 2 SEN20	PALLET DETECTED RIGHT SIDE DWELL 2 SEN21	PALLET DETECTED LEFT SIDE HEATER 3 SEN22	PALLET DETECTED RIGHT SIDE HEATER 3 SEN24	PALLET DETECTED LEFT SIDE DWELL 3 SEN25	PALLET DETECTED CENTER DWELL 3 SEN26	PALLET DETECTED RIGHT SIDE DWELL 3 SEN27	PALLET DETECTED LEFT SIDE MAGNETIC SEN28	PALLET DETECTED CENTER MAGNETIC SEN29	PALLET DETECTED RIGHT SIDE MAGNETIC SEN30
I:023	I:023	I:023	I:023	I:023	I:023	I:023	I:023	I:037	I:037	I:037
03	04	05	06	10	11	12	13	00	01	02

PALLET DETECTED LEFT SIDE DWELL 4 SEN31	PALLET DETECTED MIDDLE DWELL 4 SEN32	PALLET DETECTED RIGHT SIDE DWELL 4 SEN33	PALLET DETECTED LEFT SIDE BUFFER 3 SEN34	PALLET DETECTED RIGHT SIDE BUFFER 3 SEN36	DUMMY DUMMY
I:037	I:037	I:037	I:037	I:037	B3
03	04	05	06	10	30

:0 - -( )- - File #6 TECH_RUNGS - 4,8,9,10,11,13

Rung #013

PALLET DETECTED LEFT SIDE DWELL 5 SEN37	PALLET DETECTED CENTER DWELL 5 SEN38	PALLET DETECTED RIGHT SIDE DWELL 5 SEN39	PALLET DETECTED LEFT SIDE CARBON SEN40	PALLET DETECTED CENTER CARBON SEN41	PALLET DETECTED RIGHT SIDE CARBON SEN42	PALLET DETECTED LEFT SIDE DWELL 6 SEN43	PALLET DETECTED CENTER DWELL 6 SEN44	PALLET DETECTED RIGHT SIDE DWELL 6 SEN45	PALLET DETECTED LEFT SIDE BUFFER 4 SEN46	PALLET DETECTED RIGHT SIDE BUFFER 4 SEN48
I:037	I:037	I:037	I:053	I:053	I:053	I:053	I:053	I:053	I:053	I:053
11	12	13	00	01	02	03	04	05	06	10

PALLET DETECTED LEFT SIDE EXBUFFER SEN49	PALLET DETECTED RIGHT SIDE EXBUFFER SEN51	PALLET DETECTED LEFT SIDE EXIT LOCK SEN52	PALLET DETECTED RIGHT SIDE EXLOCK SEN54	PALLET DETECTED LEFT SIDE EXIT END SEN55	PALLET DETECTED CENTER EXIT END SEN56	PALLET DETECTED RIGHT SIDE EXIT END SEN57	DUMMY DUMMY
I:053	I:053	I:053	I:053	I:053	I:054	I:054	B3
11	13	14	16	17	16	17	30

B3/30 - -( )- - File #6 TECH_RUNGS - 4,8,9,10,11,12

Rung #014

COMPRESSOR 1 REGEN-ATION PROGRAM CYRGN1	COMPRESSOR 2 REGEN-ERATION PROGRAM CYRGN2	COMPRESSOR 3 REGEN-ERATION PROGRAM CYRGN3	COMPRESSOR 4 REGEN-ERATION PROGRAM CYRGN4	COMPRESSOR 5 REGEN-ERATION PROGRAM CYRGN5	COMPRESSOR 6 REGEN-ERATION PROGRAM CYRGN6	COMPRESSOR 7 REGEN-ERATION PROGRAM CYRGN7	COMPRESSOR 8 REGEN-ERATION PROGRAM CYRGN8	OPEN CRYO ROUGH VALVE 1 CR1	OPEN CRYO ROUGH VALVE 2 CR2
B3	B3	B3	B3	B3	B3	B3	B3	0:007	0:007
321	322	323	324	325	326	327	328	11	12
[3:0]	[3:34]	[3:38]	[3:42]	[3:46]	[3:52]	[3:57]	[3:63]	[3:15]	[3:164]

OPEN CRYO ROUGH VALVE 3 CR3	OPEN CRYO ROUGH VALVE 4 CR4	OPEN CRYO ROUGH VALVE 5 CR5	OPEN CRYO ROUGH VALVE 6 CR6	OPEN CRYO ROUGH VALVE 7 CR7	OPEN CRYO ROUGH VALVE 8 CR8	OPEN CRYO ROUGH VALVE 9 CR9	OPEN CRYO ROUGH VALVE 10 CR10	OPEN CRYO ROU VALVE 11 CR11	COMPRESSOR 1 REGEN-ERATION PROGRAM CYRGN1	COMPRESSOR 2 REGEN-ERATION PROGRAM CYRGN2
0:007	0:027	0:027	0:027	0:043	0:043	0:043	0:057	0:057	B3	B3

\>>>>>> >>>>>>>>>>> >>>>>>>>>>> >>>>>>>>>>> >>>>>>>>>>> >>>>>>>>>>> >>>>>>>>>>> >>>>>>>>>>> >>>>>>>>>>> >>>

661

<<<<<< <<<<<<<<<<<< <<<<<<<<<<<< <<<<<<<<<<<< <<<<<<<<<<<< <<<<<<<<<<<< <<<<<<<<<<<< <<<<<<<<<<<< <<<<<<<<<<<< <<<

13 11 12 13 11 12 13 11 12 321 322
[3:165] [3:167] [3:166] [3:168] [3:169] [3:170] [3:171] [3:172] [3:174] [3:0] [3:34]

B3/15 - -( )- - File #6 TECH_RUNGS - 14,15,17

Rung #015

PURGE 1 P1 B3 631 [3:5]
PURGE 2 P2 B3 632 [3:74]
PURGE 3 P3 B3 633 [3:75]
PURGE 4 P4 B3 634 [3:76]
PURGE 5 P5 B3 635 [3:77]
PURGE 6 P6 B3 636 [3:78]
PURGE 7 P7 B3 637 [3:79]
PURGE 8 P8 B3 638 [3:80]
PGC1 T4:21 TT [3:9]
PGC2 T4:22 TT [3:110]
PGC3 T4:23 TT [3:111]
PURGING TIME PGC4 T4:24 TT [3:112]
PURGING TIME 5 PGC5 T4:25 TT [3:113]
PGC6 T4:26 TT [3:114]
PGC7 T4:27 TT [3:115]
PGC8 T4:28 TT [3:116]
MECHANICAL PUMP 2 ENABLED MP2 0:027 00 [2:73]
BLOWER 2 ENABLED BL2 0:027 01 [2:74]
LINE PRESSURE MADE-TC10 LPM-TC10 B3 250 [2:671]
TEMP TEMP15 B3 ( ) 15

B3/15 - -( )- - File #6 TECH_RUNGS - 14,17

Rung #016

OPEN PURGE VALVE 1 NIF1 0:007 06 [3:7]
OPEN PURGE VALVE 2 NIF2 0:007 07 [3:88]
OPEN PURGE VALVE 3 NIF3 0:007 10 [3:89]
OPEN PURGE VALVE 4 NIF4 0:027 06 [3:91]
OPEN PURGE VALVE 5 NIF5 0:027 07 [3:90]
OPEN PURGE VALVE 6 NIF6 0:027 10 [3:92]
OPEN PURGE VALVE 7 NIF7 0:043 06 [3:93]
OPEN PURGE VALVE 8 NIF8 0:043 07 [3:94]
OPEN PURGE VALVE 9 NIF9 0:043 10 [3:95]
OPEN PURGE VALVE 10 NIF10 0:057 06 [3:96]
OPEN PURGE VALVE 11 NIF11 0:057 07 [3:98]
OPEN PURGE VALVE 12 NIF12 0:057 10 [3:97]
CRYO RE-GENERATION FAULT COMPRESSOR 1 CRFLT1 B3 331 [3:30]
CRYO RE-GENERATION FAULT COMPRESSOR 2 CRFLT2 B3 332 [3:252]
CRYO RE-GENERATION FAULT COMPRESSOR 3 CRFLT3 B3 333 [3:253]
CRYO RE-GENERATION FAULT COMPRESSOR 4 CRFLT4 B3 334 [3:254]
CRYO RE-GENERATION FAULT COMPRESSOR 5 CRFLT5 B3 335 [3:255]
CRYO RE-GENERATION FAULT COMPRESSOR 6 CRFLT6 B3 336 [3:256]
CRYO RE-GENERATI FAULT COMPRESS 7 CRFLT7 B3 337 [3:257]
OPEN PURGE VALVE 1 NIF1 0:007 06 [3:7]
OPEN PURGE VALVE 2 NIF2 0:007 07 [3:88]

Rung #017

ROUGHING AND ROR 1 R&ROR1 B3 641 [3:11]
ROUGHING AND ROR 2 R&ROR2 B3 642 [3:128]
ROUGHING AND ROR 3 R&ROR3 B3 643 [3:129]
ROUGHING AND ROR 4 R&ROR4 B3 644 [3:130]
ROUGHING AND ROR 5 R&ROR5 B3 645 [3:131]
ROUGHING AND ROR 6 R&ROR6 B3 646 [3:132]
ROUGHING AND ROR 7 R&ROR7 B3 647 [3:133]
ROUGHING AND ROR 8 R&ROR8 B3 648 [3:134]
COMPRESSOR 1 ROR LATCH CY1RORL B3 601 [3:16]
COMPRESSOR 2 ROR LATCH CY2RORL B3 602 [3:175]
COMPRESSOR 3 ROR LATCH CY3RORL B3 603 [3:177]
COMPRESSOR 4 ROR LATCH CY4RORL B3 604 [3:179]
COMPRESSOR 5 ROR LATCH CY5RORL B3 605 [3:181]
COMPRESSOR 6 ROR LATCH CY6RORL B3 606 [3:183]
COMPRESSOR 7 ROR LATCH CY7RORL B3 607 [3:185]
COMPRESSOR 8 ROR LATCH CY8RORL B3 608 [3:187]
MECHANICAL PUMP 2 TC=<50 MICRONS PIR10 I:024 13
TEMP TEMP15 B3 ( ) 15

B3/15 - -( )- - File #6 TECH_RUNGS - 14,15

Rung #018

```
|CRYO 1      CRYO 2      CRYO 3      CRYO 4      CRYO 5      CRYO 6      CRYO 7      CRYO 8      CRYO 9      CRYO 10
|THERMCOUPL  THERMCOUPL  THERMCOUPL  THERMCOUPL  THERMCOUPL  THERMCOUPL  THERMCOUPL  THERMCOUPL  THERMCOUPL  THERMCOUPL
|50 MICRON   50 MICRON   50 MICRON   50 MICRON   50 MICRON   50 MICRON   50 MICRON   50 MICRON   50 MICRON   50 MICRON
|PIR3        PIR4        PIR5        PIR7        PIR8        PIR9        PIR12       PIR13       PIR14       PIR18
|  I:004       I:004       I:004       I:024       I:024       I:024       I:040       I:040       I:040       I:054
|--] [---------] [---------] [---------] [---------] [---------] [---------] [---------] [---------] [---------] [--
|   11          12          13          10          11          12          10          11          12          11
| B3/16 - -( )- - File #6 TECH_RUNGS - 22
                                                                                                            |CRYO 1
                                                                                                            |THERMCOU
   CRYO 11     CRYO 12                                                                                      |50 MICRO
   THERMCOUPL  THERMCOUPL                                                                                   |PIR3
   50 MICRON   50 MICRON   C1RORTMR  C2RORTMR  C3RORTMR  C4RORTMR  C5RORTMR  C6RORTMR  C7RORTMR  C8RORTMR  |  I:004
   PIR19       PIR20        T4:31     T4:32     T4:33     T4:34     T4:35     T4:36     T4:37     T4:38    |--] [--
     I:054       I:054    ---] [------] [------] [------] [------] [------] [------] [------] [-----|   11
  ----] [---------] [--       TT        TT        TT        TT        TT        TT        TT        TT     |
      12          13       [3:18]    [3:189]   [3:190]   [3:191]   [3:192]   [3:193]   [3:194]   [3:195]   | B3/16 -
```

Rung #019

```
|                                                                                      ENABLE      ENABLE      ENABLE
|                                                                                      CRYO        CRYO        CRYO
|COOL DOWN  COOL DOWN  COOL DOWN  COOL DOWN  COOL DOWN  COOL DOWN  COOL DOWN  COOL DOWN  COMPRESSOR  COMPRESSOR  COMPRESSOR
|1          2          3          4          5          6          7          8          1           2           3
|CD1        CD2        CD3        CD4        CD5        CD6        CD7        CD8        CY1         CY2         CY3
|  B3         B3         B3         B3         B3         B3         B3         B3        O:010       O:010       O:030
|--] [--------] [--------] [--------] [--------] [--------] [--------] [--------] [--------] [---------] [---------] [--
|  651        652        653        654        655        656        657        658        04          05          04
    20]     [3:203]    [3:204]    [3:205]    [3:206]    [3:207]    [3:208]    [3:209]    [2:26]      [2:27]      [2:28]
                                          ENABLE      ENABLE      ENABLE      ENABLE      ENABLE                  |
                                          CRYO        CRYO        CRYO        CRYO        CRYO                    |
                                          COMPRESSOR  COMPRESSOR  COMPRESSOR  COMPRESSOR  COMPRESSOR              |
                                          4           5           6           7           8           TEMP 20     |
                                          CY4         CY5         CY6         CY7         CY8         TMP20       |
                                            O:030       O:044       O:044       O:060       O:060       B3        |
                                          ----] [---------] [---------] [---------] [---------] [--------( )------|
                                              05          04          05          04          05         20       |
                                          [2:29]      [2:30]      [2:31]      [2:32]      [2:33]                  |
```

Rung #020

```
|CYRO 1      CRYO 2      CRYO 3      CRYO 4      CRYO 5      CRYO 6      CRYO 7      CRYO 8      CRYO 9      CYRO 10
|TEMPERATUR  TEMPERATUR  TEMPERATUR  TEMPERATUR  TEMPERATUR  TEMPERATUR  TEMPERATUR  TEMPERATUR  TEMPERATUR  TEMPERATUR
|=>290K      =>290K      =>290K      =>290K      =>290K      =>290K      =>290K      =>290K      =>290K      =>290K
|CY1TMP290   CY2TMP290   CY3TMP290   CY4TMP290   CY5TMP290   CY6TMP290   CY7TMP290   CY8TMP290   CY9TMP290   CY10TMP290
|  B3          B3          B3          B3          B3          B3          B3          B3          B3          B3
|--] [---------] [---------] [---------] [---------] [---------] [---------] [---------] [---------] [---------] [--
|  513         514         515         516         517         518         519         520         521         522
                                                                                                CRYO 11     CRYO 12          |
                                                                                                TEMPERATUR  TEMPERATUR       |
                                                                                                =>290K      =>290K           |
                                                                                                CY11TMP290  CY12TMP290       |
                                                                                                  B3          B3        B3   |
                                                                                                ---] [---------] [-------( )-|
                                                                                                  523         524       25   |
```

Rung #021

```
|CRYO 1      CRYO 2      CRYO 3      CRYO 4      CRYO 5      CRYO 6      CRYO 7      CRYO 8      CRYO 9      CRYO 10
|TEMPERATUR  TEMPERATUR  TEMPERATUR  TEMPERATUR  TEMPERATUR  TEMPERATUR  TEMPERATUR  TEMPERATUR  TEMPERATUR  TEMPERATUR
|=<20K       =<20K       =<20K       =<20K       =<20K       =<20K       =<20K       =<20K       =<20K       =<20K
|CY1TMP20    CY2TMP20    CY3TMP20    CY4TMP20    CY5TMP20    CY6TMP20    CY7TMP20    CY8TMP20    CY9TMP20    CY10TMP20
|  B3          B3          B3          B3          B3          B3          B3          B3          B3          B3
|--] [---------] [---------] [---------] [---------] [---------] [---------] [---------] [---------] [---------] [--
|  501         502         503         504         505         506         507         508         509         510
                                                                                                CRYO 11     CRYO 12            |
                                                                                                TEMPERATUR  TEMPERATUR         |
                                                                                                =<20K       =<20K      TEMP 21 |
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663

SECTION N

664

CA -- GENERAL CALCULATION

TAG	EL	EH	ET	RN	OUTPUT	B	C	D	E	F	G	H	NX	CP
TD2CALC	0	432	DegK	Y	OUTPUT = ((B*A)+C)	TD2H	TD2B	0.0000	0.0000	0.0000	0.00	0.00	TD2AB	.
TD3CALC	0	432	DegK	Y	OUTPUT = ((B*A)+C)	TD3H	TD3B	0.0000	0.0000	0.0000	0.00	0.00	TD3AB	.
TD4CALC	0	432	DegK	Y	OUTPUT = ((B*A)+C)	TD4H	TD4B	0.0000	0.0000	0.0000	0.00	0.00	TD4AB	.
TD5CALC	0	432	DegK	Y	OUTPUT = ((B*A)+C)	TD5H	TD5B	0.0000	0.0000	0.0000	0.00	0.00	TD5AB	.
TD6CALC	0	432	DegK	Y	OUTPUT = ((B*A)+C)	TD6H	TD6B	0.0000	0.0000	0.0000	0.00	0.00	TD6AB	.
TD7CALC	0	432	DegK	Y	OUTPUT = ((B*A)+C)	TD7H	TD7B	0.0000	0.0000	0.0000	0.00	0.00	TD7AB	.
TD8CALC	0	432	DegK	Y	OUTPUT = ((B*A)+C)	TD8H	TD8B	0.0000	0.0000	0.0000	0.00	0.00	TD8AB	.
TD9CALC	0	432	DegK	Y	OUTPUT = ((B*A)+C)	TD9H	TD9B	0.0000	0.0000	0.0000	0.00	0.00	TD9AB	.
TD10CALC	0	432	DegK	Y	OUTPUT = ((B*A)+C)	TD10H	TD10B	0.0000	0.0000	0.0000	0.00	0.00	TD10AB	.
TD11CALC	0	432	DegK	Y	OUTPUT = ((B*A)+C)	TD11H	TD11B	0.0000	0.0000	0.0000	0.00	0.00	TD11AB	.
TD12CALC	0	432	DegK	Y	OUTPUT = ((B*A)+C)	TD12H	TD12B	0.0000	0.0000	0.0000	0.00	0.00	TD12AB	.
TD1CALC	0	432	DegK	Y	OUTPUT = ((B*A)+C)	TD1H	TD1B	0.0000	0.0000	0.0000	0.00	0.00	TD1AB	.
HCAL1	0.00	100.00	PCT	N	OUTPUT = ((((C/D)*B)*A)/E)	240.00	HSP1	100.00	1000.0	0.00	0.00	0.00	.	
HCAL2	0.00	100.00	PCT	N	OUTPUT = ((((C/D)*B)*A)/E)	240.00	HSP2	100.00	1000.0	0.00	0.00	0.00	.	
HCAL3	0.00	100.00	PCT	N	OUTPUT = ((((C/D)*B)*A)/E)	240.00	HSP3	100.00	1000.0	0.00	0.00	0.00	.	
HCAL4	0.00	100.00	PCT	N	OUTPUT = ((((C/D)*A)*B)/E)	240.00	HSP4	100.00	1000.0	0.00	0.00	0.00	.	
HCAL5	0.00	100.00	PCT	N	OUTPUT = ((((C/D)*B)*A)/E)	240.00	HSP5	100.00	1000.0	0.00	0.00	0.00	.	
HCAL6	0.00	100.00	PCT	N	OUTPUT = ((((C/D)*A)*B)/E)	240.00	HSP6	100.00	1000.0	0.00	0.00	0.00	.	
HCAL7	0.00	100.00	PCT	N	OUTPUT = ((((C/D)*A)*B)/E)	240.00	HSP7	100.00	1000.0	0.00	0.00	0.00	.	
HCAL8	0.00	100.00	PCT	N	OUTPUT = ((((C/D)*A)*B)/E)	240.00	HSP8	100.00	1000.0	0.00	0.00	0.00	.	
OCALC1A	0.0	80.0	amps	Y	OUTPUT = (A*B)	PSF1	0.00	0.00	0.00	0.00	0.00	0.00	PSSP1A	.
OCALC2A	0.0	80.0	amps	Y	OUTPUT = (A*B)	PSF2	0.00	0.00	0.00	0.00	0.00	0.00	PSSP2A	.
OCALC3A	0.0	80.0	amps	Y	OUTPUT = (A*B)	PSF3	0.00	0.00	0.00	0.00	0.00	0.00	PSSP3A	.
OCALC4A	0.0	80.0	amps	Y	OUTPUT = (A*B)	PSF4	0.00	0.00	0.00	0.00	0.00	0.00	PSSP4A	.
OCALC1B	0.0	80.0	amps	Y	OUTPUT = (A*B)	PSF1	0.00	0.00	0.00	0.00	0.00	0.00	PSSP1B	.
OCALC2B	0.0	80.0	amps	Y	OUTPUT = (A*B)	PSF2	0.00	0.00	0.00	0.00	0.00	0.00	PSSP2B	.
OCALC3B	0.0	80.0	amps	Y	OUTPUT = (A*B)	PSF3	0.00	0.00	0.00	0.00	0.00	0.00	PSSP3B	.
OCALC4B	0.0	80.0	amps	Y	OUTPUT = (A*B)	PSF4	0.00	0.00	0.00	0.00	0.00	0.00	PSSP4B	.
OCALC5A	0.0	80.0	amps	Y	OUTPUT = (A*B)	PSF5	0.00	0.00	0.00	0.00	0.00	0.00	PSSP5A	.
OCALC6A	0.0	80.0	amps	Y	OUTPUT = (A*B)	PSF6	0.00	0.00	0.00	0.00	0.00	0.00	PSSP6A	.
OCALC5B	0.0	80.0	amps	Y	OUTPUT = (A*B)	PSF5	0.00	0.00	0.00	0.00	0.00	0.00	PSSP5B	.
OCALC6B	0.0	80.0	amps	Y	OUTPUT = (A*B)	PSF6	0.00	0.00	0.00	0.00	0.00	0.00	PSSP6B	.
OCALC7A	0.0	80.0	amps	Y	OUTPUT = (A*B)	PSF7	0.00	0.00	0.00	0.00	0.00	0.00	PSSP7A	.
OCALC8A	0.0	80.0	amps	Y	OUTPUT = (A*B)	PSF8	0.00	0.00	0.00	0.00	0.00	0.00	PSSP8A	.
OCALC7B	0.0	80.0	amps	Y	OUTPUT = (A*B)	PSF7	0.00	0.00	0.00	0.00	0.00	0.00	PSSP7B	.
OCALC8B	0.0	80.0	amps	Y	OUTPUT = (A*B)	PSF8	0.00	0.00	0.00	0.00	0.00	0.00	PSSP8B	.
OCALC9A	0.0	80.0	amps	Y	OUTPUT = (A*B)	PSF9	0.00	0.00	0.00	0.00	0.00	0.00	PSSP9A	.
OCALC10A	0.0	80.0	amps	Y	OUTPUT = (A*B)	PSF10	0.00	0.00	0.00	0.00	0.00	0.00	PSSP10A	.
OCALC11A	0.0	80.0	amps	Y	OUTPUT = (A*B)	PSF11	0.00	0.00	0.00	0.00	0.00	0.00	PSSP11A	.
OCALC12A	0.0	80.0	amps	Y	OUTPUT = (A*B)	PSF12	0.00	0.00	0.00	0.00	0.00	0.00	PSSP12A	.
OCALC9B	0.0	80.0	amps	Y	OUTPUT = (A*B)	PSF9	0.00	0.00	0.00	0.00	0.00	0.00	PSSP9B	.
OCALC10B	0.0	80.0	amps	Y	OUTPUT = (A*B)	PSF10	0.00	0.00	0.00	0.00	0.00	0.00	PSSP10B	.
OCALC11B	0.0	80.0	amps	Y	OUTPUT = (A*B)	PSF11	0.00	0.00	0.00	0.00	0.00	0.00	PSSP11B	.
OCALC12B	0.0	80.0	amps	Y	OUTPUT = (A*B)	PSF12	0.00	0.00	0.00	0.00	0.00	0.00	PSSP12B	.
ICALC2A	0.0	40.0	PCT	Y	OUTPUT = (A/B)	PSF2	0.0000	0.00	0.00	0.00	0.00	0.00	.	
ICALC1A	0.0	40.0	.	Y	OUTPUT = (A/B)	PSF1	0.00	0.00	0.00	0.00	0.00	0.00	.	

PCT/US 92/00722

TAG	EL	EH	ET	RN	OUTPUT	B	C	D	E	F	G	H	NX	CP
ICALC3A	0.0	40.0	.	Y	OUTPUT = (A/B)	PSF3	0.00	0.00	0.00	0.00	0.00	0.00	.	
ICALC4A	0.0	40.0	.	Y	OUTPUT = (A/B)	PSF4	0.00	0.00	0.00	0.00	0.00	0.00	.	
ICALC1B	0.0	40.0	.	Y	OUTPUT = (A/B)	PSF1	0.00	0.00	0.00	0.00	0.00	0.00	.	
ICALC2B	0.0	40.0	.	Y	OUTPUT = (A/B)	PSF2	0.00	0.00	0.00	0.00	0.00	0.00	.	
ICALC3B	0.0	40.0	.	Y	OUTPUT = (A/B)	PSF3	0.00	0.00	0.00	0.00	0.00	0.00	.	
ICALC4B	0.0	40.0	.	Y	OUTPUT = (A/B)	PSF4	0.00	0.00	0.00	0.00	0.00	0.00	.	
ICALC5A	0.0	40.0	.	Y	OUTPUT = (A/B)	PSF5	0.00	0.00	0.00	0.00	0.00	0.00	.	
ICALC6A	0.0	40.0	.	Y	OUTPUT = (A/B)	PSF6	0.00	0.00	0.00	0.00	0.00	0.00	.	
ICALC5B	0.0	40.0	.	Y	OUTPUT = (A/B)	PSF5	0.00	0.00	0.00	0.00	0.00	0.00	.	
ICALC6B	0.0	40.0	.	Y	OUTPUT = (A/B)	PSF6	0.00	0.00	0.00	0.00	0.00	0.00	.	
ICALC7A	0.0	40.0	.	Y	OUTPUT = (A/B)	PSF7	0.00	0.00	0.00	0.00	0.00	0.00	.	
ICALC8A	0.0	40.0	.	Y	OUTPUT = (A/B)	PSF8	0.00	0.00	0.00	0.00	0.00	0.00	.	
ICALC7B	0.0	40.0	.	Y	OUTPUT = (A/B)	PSF7	0.00	0.00	0.00	0.00	0.00	0.00	.	
ICALC8B	0.0	40.0	.	Y	OUTPUT = (A/B)	PSF8	0.00	0.00	0.00	0.00	0.00	0.00	.	
ICALC9A	0.0	40.0	.	Y	OUTPUT = (A/B)	PSF9	0.00	0.00	0.00	0.00	0.00	0.00	.	
ICALC10A	0.0	40.0	.	Y	OUTPUT = (A/B)	PSF10	0.00	0.00	0.00	0.00	0.00	0.00	.	
ICALC11A	0.0	40.0	.	Y	OUTPUT = (A/B)	PSF11	0.00	0.00	0.00	0.00	0.00	0.00	.	
ICALC12A	0.0	40.0	.	Y	OUTPUT = (A/B)	PSF12	0.00	0.00	0.00	0.00	0.00	0.00	.	
ICALC9B	0.0	40.0	.	Y	OUTPUT = (A/B)	PSF9	0.00	0.00	0.00	0.00	0.00	0.00	.	
ICALC10B	0.0	40.0	.	Y	OUTPUT = (A/B)	PSF10	0.00	0.00	0.00	0.00	0.00	0.00	.	
ICALC11B	0.0	40.0	.	Y	OUTPUT = (A/B)	PSF11	0.00	0.00	0.00	0.00	0.00	0.00	.	
ICALC12B	0.0	40.0	.	Y	OUTPUT = (A/B)	PSF12	0.00	0.00	0.00	0.00	0.00	0.00	.	
HV1CLC	0	32767	.	N	OUTPUT = (((A*B)+(C*D))+(E*F)	10.000	0.00	100.00	HV1S3	1000.0	0.00	0.00	HV1ANA	.
HV2CLC	0	32767	.	N	OUTPUT = (((A*B)+(C*D))+(E*F)	10.000	HV2S2	100.00	HV2S3	1000.0	0.00	0.00	HV2ANA	.
DR1CLC	0	32767	.	N	OUTPUT = ((A*B)+(C*D))	10.000	DROP1S	1000.0	0.00	0.00	0.00	0.00	DR1ANA	.
HV3CLC	0	32767	.	N	OUTPUT = (((A*B)+(C*D))+(E*F)	10.000	HV3S2	100.00	HV3S3	1000.0	0.00	0.00	HV3ANA	.
HV4CLC	0	32767	.	N	OUTPUT = (((A*B)+(C*D))+(E*F)	10.000	HV4S2	100.00	HV4S3	1000.0	0.00	0.00	HV4ANA	.
HV5CLC	0	32767	.	N	OUTPUT = (((A*B)+(C*D))+(E*F)	10.000	HV5S2	100.00	HV5S3	1000.0	0.00	0.00	HV5ANA	.
HV6CLC	0	32767	.	N	OUTPUT = (((A*B)+(C*D))+(E*F)	10.000	HV6S2	100.00	HV6S3	1000.0	0.00	0.00	HV6ANA	.
DR2CLC	0	32767	.	N	OUTPUT = ((A*B)+(C*D))	10.000	DROP2S	1000.0	0.00	0.00	0.00	0.00	DR2ANA	.
DR3CLC	0	32767	.	N	OUTPUT = ((A*B)+(C*D))	10.000	DROP3S	1000.0	0.00	0.00	0.00	0.00	DR3ANA	.
DR4CLC	0	32767	.	N	OUTPUT = ((A*B)+(C*D))	10.000	DROP4S	1000.0	0.00	0.00	0.00	0.00	DR4ANA	.
DR5CLC	0	32767	.	N	OUTPUT = ((A*B)+(C*D))	10.000	DROP5S	1000.0	0.00	0.00	0.00	0.00	DR5ANA	.
DR6CLC	0	32767	.	N	OUTPUT = ((A*B)+(C*D))	10.000	DROP6S	1000.0	0.00	0.00	0.00	0.00	DR6ANA	.
HV7CLC	0	32767	.	N	OUTPUT = (((A*B)+(C*D))+(E*F)	10.000	HV7S2	100.00	HV7S3	1000.0	0.00	0.00	HV7ANA	.
HV8CLC	0	32767	.	N	OUTPUT = (((A*B)+(C*D))+(E*F)	10.000	HV8S2	100.00	HV8S3	1000.0	0.00	0.00	HV8ANA	.
HV9CLC	0	32767	.	N	OUTPUT = (((A*B)+(C*D))+(E*F)	10.000	HV9S2	100.00	HV9S3	1000.0	0.00	0.00	HV9ANA	.
HV10CLC	0	32767	.	N	OUTPUT = (((A*B)+(C*D))+(E*F)	10.000	HV10S2	100.00	HV10S3	1000.0	0.00	0.00	HV10ANA	.
HV11CLC	0	32767	.	N	OUTPUT = (((A*B)+(C*D))+(E*F)	10.000	HV11S2	100.00	HV11S3	1000.0	0.00	0.00	HV11ANA	.
HV12CLC	0	32767	.	N	OUTPUT = (((A*B)+(C*D))+(E*F)	10.000	HV12S2	100.00	HV12S3	1000.0	0.00	0.00	HV12ANA	.
DR7CLC	0	32767	.	N	OUTPUT = ((A*B)+(C*D))	10.000	DROP7S	1000.0	0.00	0.00	0.00	0.00	DR7ANA	.
DR8CLC	0	32767	.	N	OUTPUT = ((A*B)+(C*D))	10.000	DROP8S	1000.0	0.00	0.00	0.00	0.00	DR8ANA	.
DR9CLC	0	32767	.	N	OUTPUT = ((A*B)+(C*D))	10.000	DROP9S	1000.0	0.00	0.00	0.00	0.00	DR9ANA	.
DR10CLC	0	32767	.	N	OUTPUT = ((A*B)+(C*D))	10.000	DROP10S	1000.0	0.00	0.00	0.00	0.00	DR10ANA	.
DR11CLC	0	32767	.	N	OUTPUT = ((A*B)+(C*D))	10.000	DROP11S	1000.0	0.00	0.00	0.00	0.00	DR11ANA	.
DR12CLC	0	32767	.	N	OUTPUT = ((A*B)+(C*D))	10.000	DROP12S	1000.0	0.00	0.00	0.00	0.00	DR12ANA	.

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BL -- BOOLEAN BLOCK

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TAG	CT_CLO	OT_OP	ST_SC	IS_I	OUTPUT EQUAL	A_INPUT	B_INPUT	C_INPUT	D_INPUT	E_INPUT	F_INPUT	G_	H_	DESC	CP_COPY TO
PSBL1	CLOSE	OPEN	2	ON	(((((A+B)+C)+D)+E)+F)	PSON1	PSON2	PSON3	PSON4	PSON5	PSON6	0	0	Power Supplies on logic	PSAUTO1
PSBL2	CLOSE	OPEN	2	ON	(((((A+B)+C)+D)+E)+F)	PSON7	PSON8	PSON9	PSON10	PSON11	PSON12	0	0	Power Supplies on logic	PSAUTO2
PSFI1	CLOSE	OPEN	2:1	ON	(((((A*B)*C)*D)*E)*F)	CHR1A	CHR2A	CHR3A	CHR4A	CHRS1	CHRS2	0	0	Water Flow Interlock: PS1A-4A	PSIW1
PSFI2	CLOSE	OPEN	2:1	ON	(((((A*B)*C)*D)*E)*F)	CHR1B	CHR2B	CHR3B	CHR4B	CHRS1	CHRS2	0	0	Water Flow Interlock: PS1B-4B	PSIW2
PSFI3	CLOSE	OPEN	2	ON	(((((A*B)*C)*D)*E)*F)	MAG5A	MAG6A	MAG5B	MAG6B	MAGS1	MAGS2	0	0	Water Flow Interlocks: PS5 & 6	PSIW3
PSFI4	CLOSE	OPEN	2	ON	(((((A*B)*C)*D)*E)*F)	MAG7A	MAG8A	MAG7B	MAG8B	MAGS1	MAGS2	0	0	Water Flow Interlocks: PS7 & 8	PSIW4
PSFI5	CLOSE	OPEN	2:1	ON	(((((A*B)*C)*D)*E)*F)	CAR9A	CAR10A	CAR11A	CAR12A	CARS1	CARS2	0	0	Water Flow Interlocks: PS9A-12A	PSIW5
PSFI6	CLOSE	OPEN	2	ON	(((((A*B)*C)*D)*E)*F)	CAR9B	CAR10B	CAR11B	CAR12B	CARS1	CARS2	0	0	Water Flow Interlocks: PS9B-12B	PSIW6
PSXI1	CLOSE	OPEN	2	ON	(A*B)	CC5	CC6	0	0	0	0	0	0	Cover Interlocks - Chrome	PSIX1
PSXI2	CLOSE	OPEN	2:1	ON	(A*B)	CC5	CC6	0	0	0	0	0	0	Cover Interlocks - Chrome	PSIX2
PSXI3	CLOSE	OPEN	2	ON	(A*B)	CC9	CC10	0	0	0	0	0	0	Cover Interlocks - Mag	PSIX3
PSXI4	CLOSE	OPEN	2:1	ON	(A*B)	CC9	CC10	0	0	0	0	0	0	Cover Interlocks - Mag	PSIX4
PSXI5	CLOSE	OPEN	2	ON	(A*B)	CC11	CC12	0	0	0	0	0	0	Cover Interlocks - Carbon	PSIX5
PSXI6	CLOSE	OPEN	2:1	ON	(A*B)	CC11	CC12	0	0	0	0	0	0	Cover Interlocks - Carbon	PSIX6
14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14

PG--PROGRAM BLOCK

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TAG	AD_	AP	ST_SCA	IS_IN	IA_I	DESC	PROGRAM				
COMPG	TH	L	1		ON	AUTO AB/Fix Communications Detect	00	MAXWAIT	10		
							01	OPEN	CONTIN		
							02	WAITFOR	CONTIN	= CLOSE	
							03	CLOSE	CONTIN		
							04	NUL			
							05	NUL			
							06	NUL			
							07	NUL			
							08	NUL			
							09	NUL			
							10	NUL			
							11	NUL			
							12	NUL			
							13	NUL			
							14	NUL			
							15	NUL			
							16	NUL			
							17	NUL			
							18	NUL			
							19	NUL			
CTRSTPG	TH	L	5		ON	AUTO Pallet counter reset program	00	MAXWAIT	6		
							01	IF	CTRST	= OPEN	GOTO 4
							02	WAITFOR	CTRST	= OPEN	
							03	OPEN	CTRST		
							04	GOTO	0		
							05	NUL			
							06	NUL			
							07	NUL			
							08	NUL			
							09	NUL			
							10	NUL			
							11	NUL			
							12	NUL			
							13	NUL			
							14	NUL			
							15	NUL			
							16	NUL			
							17	NUL			
							18	NUL			
							19	NUL			

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TAG	AD_	AP	ST_SCA	IS_IN	IA_I	DESC	PROGRAM				
-------	---	--	------	-----	----		00	SETLIM	10.00		
GASPG1	TH	L	2:1		OFF	AUTO Gas Control Heater 1	01	IF	GF1	= OPEN	GOTO 5
							02	NUL			
							03	SETOUT	FLOST1	FLOSP1	
							04	GOTO	6		
							05	SETOUT	FLOST1	0	
							06	IF	GF2	= OPEN	GOTO 10
							07	NUL			
							08	SETOUT	FLOST2	FLOSP2	
							09	GOTO	0		
							10	SETOUT	FLOST2	0	
							11	GOTO	0		
							12	NUL			
							13	NUL			
							14	NUL			
							15	NUL			
							16	NUL			
							17	NUL			
							18	NUL			
							19	NUL			
							00	SETLIM	10.00		
GASPG2	TH	L	2		OFF	AUTO Gas Control Chrome	01	IF	GF3	= OPEN	GOTO 5
							02	NUL			
							03	SETOUT	FLOST3	FLOSP3	
							04	GOTO	6		
							05	SETOUT	FLOST3	0	
							06	IF	GF4	= OPEN	GOTO 10
							07	NUL			
							08	SETOUT	FLOST4	FLOSP4	
							09	GOTO	0		
							10	SETOUT	FLOSP4	0	
							11	GOTO	0		
							12	NUL			
							13	NUL			
							14	NUL			
							15	NUL			
							16	NUL			
							17	NUL			
							18	NUL			
							19	NUL			

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TAG	AD_	AP	ST_SCA	IS_IN	IA_I	DESC	PROGRAM					
GASPG3	TH	L	2:1		OFF	AUTO Gas Control Mag	00	SETLIM	10.00			
							01	IF	GF5	= OPEN	GOTO 5	
							02	NUL				
							03	SETOUT	FLOST5	FLOSP5		
							04	GOTO	6			
							05	SETOUT	FLOST5	0		
							06	IF	GF6	= OPEN	GOTO 10	
							07	NUL				
							08	SETOUT	FLOST6	FLOSP6		
							09	GOTO	0			
							10	SETOUT	FLOST6	0		
							11	GOTO	0			
							12	NUL				
							13	NUL				
							14	NUL				
							15	NUL				
							16	NUL				
							17	NUL				
							18	NUL				
							19	NUL				
GASPG4	TH	L	2		OFF	AUTO Gas Control Carbon	00	SETLIM	10.00			
							01	IF	GF7	= OPEN	GOTO 5	
							02	NUL				
							03	SETOUT	FLOST7	FLOSP7		
							04	GOTO	6			
							05	SETOUT	FLOST7	0		
							06	IF	GF8	= OPEN	GOTO 10	
							07	NUL				
							08	SETOUT	FLOST8	FLOSP8		
							09	GOTO	0			
							10	SETOUT	FLOSP8	0		
							11	GOTO	0			
							12	NUL				
							13	NUL				
							14	NUL				
							15	NUL				
							16	NUL				
							17	NUL				
							18	NUL				
							19	NUL				

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TAG	AD_	AP	ST_SCA	IS_IN	IA_I	DESC	PROGRAM				
HTALPG	TH	L	2		ON	AUTO Heater Alarm Program	00	SETLIM	2.00		
							01	MAXWAIT	20		
							02	IF	RH1A	= OFF	GOTO 6
							03	WAITFOR	RH1A	= OFF	
							04	IF	HVO1	<	10.0 GOTO 18
							05	IF	HVO2	<	10.0 GOTO 18
							06	IF	RH2A	= OFF	GOTO 11
							07	WAITFOR	RH2A	= OFF	
							08	IF	HVO3	<	10.0 GOTO 18
							09	IF	HVO4	<	10.0 GOTO 18
							10	IF	HVO5	<	10.0 GOTO 18
							11	IF	RH3A	= OFF	GOTO 16
							12	WAITFOR	RH3A	= OFF	
							13	IF	HVO6	<	10.0 GOTO 18
							14	IF	HVO7	<	10.0 GOTO 18
							15	IF	HVO8	<	10.0 GOTO 18
							16	OPEN	HTALM		
							17	GOTO	0		
							18	CLOSE	HTALM		
							19	GOTO	0		
PGRUN	TH	L	30		ON	AUTO Run Flow and Pressure Blocks	00	IF	AUTO1	!= Off	GOTO 9
							01	IF	AUTO2	!= Off	GOTO 9
							02	STOP	CM2		
							03	STOP	CM3		
							04	STOP	CM4		
							05	STOP	FLO3		
							06	STOP	FLO5		
							07	STOP	FLO7		
							08	GOTO	0		
							09	RUN	CM2		
							10	RUN	CM3		
							11	RUN	CM4		
							12	RUN	FLO3		
							13	RUN	FLO5		
							14	RUN	FLO7		
							15	GOTO	0		
							16	NUL			
							17	NUL			
							18	NUL			
							19	NUL			

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TAG	AD_	AP	ST_SCA	IS_IN	IA_I	DESC	PROGRAM				
-------	---	--	------	-----	----	----					
PSALPG1	TH	L	3		ON	AUTO Power Supply Setpoint Alarm	00	MAXWAIT	20		
							01	NUL			
							02	IF	PSON1	= Off	GOTO 6
							03	WAITFOR	PSSR1A	= OPEN	
							04	IF	PSSR1A	= CLOSE	GOTO 12
							05	IF	PSSR1B	= CLOSE	GOTO 12
							06	IF	PSON2	= Off	GOTO 10
							07	WAITFOR	PSSR2A	= OPEN	
							08	IF	PSSR2A	= CLOSE	GOTO 12
							09	IF	PSSR2B	= CLOSE	GOTO 12
							10	OPEN	CHRAL1		
							11	GOTO	0		
							12	CLOSE	CHRAL1		
							13	GOTO	0		
							14	NUL			
							15	NUL			
							16	NUL			
							17	NUL			
							18	NUL			
							19	NUL			
PSALPG10	TH	L	3		ON	AUTO Power Supply Setpoint Alarm	00	MAXWAIT	20		
							01	NUL			
							02	IF	PSON3	= Off	GOTO 6
							03	WAITFOR	PSARC3A	= OPEN	
							04	IF	PSARC3A	= OPEN	GOTO 12
							05	IF	PSARC3B	= OPEN	GOTO 12
							06	IF	PSON4	= Off	GOTO 10
							07	WAITFOR	PSARC4A	= OPEN	
							08	IF	PSARC4A	= OPEN	GOTO 12
							09	IF	PSARC4B	= OPEN	GOTO 12
							10	OPEN	CHARC2		
							11	GOTO	0		
							12	CLOSE	CHARC2		
							13	GOTO	0		
							14	NUL			
							15	NUL			
							16	NUL			
							17	NUL			
							18	NUL			
							19	NUL			

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TAG	AD_	AP	ST_SCA	IS_IN	IA_I	DESC
PSALPG11	TH	L	3:1	ON	AUTO	Power Supply Setpoint Alarm

PROGRAM

00	MAXWAIT	20		
01	NUL			
•02	IF	PSON7	= Off	GOTO 6
03	WAITFOR	PSARC7A	= OPEN	
04	IF	PSARC7A	= OPEN	GOTO 12
05	IF	PSARC7B	= OPEN	GOTO 12
06	IF	PSON8	= Off	GOTO 10
07	WAITFOR	PSARC8A	= OPEN	
08	IF	PSARC8A	= OPEN	GOTO 12
09	IF	PSARC8B	= OPEN	GOTO 12
10	OPEN	MGARC2		
11	GOTO	0		
12	CLOSE	MGARC2		
13	GOTO	0		
14	NUL			
15	NUL			
16	NUL			
17	NUL			
18	NUL			
19	NUL			

TAG	AD_	AP	ST_SCA	IS_IN	IA_I	DESC
PSALPG12	TH	L	3:2	ON	AUTO	Power Supply Setpoint Alarm

PROGRAM

00	MAXWAIT	20		
01	NUL			
02	IF	PSON11	= Off	GOTO 6
03	WAITFOR	PSARC11A	= OPEN	
04	IF	PSARC11A	= OPEN	GOTO 12
05	IF	PSARC11B	= OPEN	GOTO 12
06	IF	PSON12	= Off	GOTO 10
07	WAITFOR	PSARC20	= OPEN	
08	IF	PSARC20	= OPEN	GOTO 12
09	NUL			
10	OPEN	CAARC2		
11	GOTO	0		
12	CLOSE	CAARC2		
13	GOTO	0		
14	NUL			
15	NUL			
16	NUL			
17	NUL			
18	NUL			
19	NUL			

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TAG	AD_	AP	ST_SCA	IS_IN	IA_I	DESC	PROGRAM				
PSALPG2	TH	L	3:1		ON	AUTO Power Supply Setpoint Alarm	00	MAXWAIT	20		
							01	NUL			
							02	IF	PSON5	= Off	GOTO 6
							03	WAITFOR	PSSR5A	= OPEN	
							04	IF	PSSR5A	= CLOSE	GOTO 12
							05	IF	PSSR5B	= CLOSE	GOTO 12
							06	IF	PSON6	= Off	GOTO 10
							07	WAITFOR	PSSR6A	= OPEN	
							08	IF	PSSR6A	= CLOSE	GOTO 12
							09	IF	PSSR6B	= CLOSE	GOTO 12
							10	OPEN	MAGAL1		
							11	GOTO	0		
							12	CLOSE	MAGAL1		
							13	GOTO	0		
							14	NUL			
							15	NUL			
							16	NUL			
							17	NUL			
							18	NUL			
							19	NUL			
PSALPG3	TH	L	3:2		ON	AUTO Power Supply Setpoint Alarm	00	MAXWAIT	20		
							01	NUL			
							02	IF	PSON9	= Off	GOTO 6
							03	WAITFOR	PSSR9A	= OPEN	
							04	IF	PSSR9A	= CLOSE	GOTO 12
							05	IF	PSSR9B	= CLOSE	GOTO 12
							06	IF	PSON10	= Off	GOTO 10
							07	WAITFOR	PSSR10A	= OPEN	
							08	IF	PSSR10A	= CLOSE	GOTO 12
							09	IF	PSSR10B	= CLOSE	GOTO 12
							10	OPEN	CARAL1		
							11	GOTO	0		
							12	CLOSE	CARAL1		
							13	GOTO	0		
							14	NUL			
							15	NUL			
							16	NUL			
							17	NUL			
							18	NUL			
							19	NUL			

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TAG	AD_	AP	ST_SCA	IS_IN	IA_I	DESC	PROGRAM					
PSALPG4	TH	L	3	ON		AUTO Power Supply Setpoint Alarm	00	MAXWAIT	20			
							01	NUL				
							02	IF	PSON3	= Off	GOTO	6
							03	WAITFOR	PSSR3A	= OPEN		
							04	IF	PSSR3A	= CLOSE	GOTO	12
							05	IF	PSSR3B	= CLOSE	GOTO	12
							06	IF	PSON4	= Off	GOTO	10
							07	WAITFOR	PSSR4A	= OPEN		
							08	IF	PSSR4A	= CLOSE	GOTO	12
							09	IF	PSSR4B	= CLOSE	GOTO	12
							10	OPEN	CHRAL2			
							11	GOTO	0			
							12	CLOSE	CHRAL2			
							13	GOTO	0			
							14	NUL				
							15	NUL				
							16	NUL				
							17	NUL				
							18	NUL				
							19	NUL				
PSALPG5	TH	L	3:1	ON		AUTO Power Supply Setpoint Alarm	00	MAXWAIT	20			
							01	NUL				
							02	IF	PSON7	= Off	GOTO	6
							03	WAITFOR	PSSR7A	= OPEN		
							04	IF	PSSR7A	= CLOSE	GOTO	12
							05	IF	PSSR7B	= CLOSE	GOTO	12
							06	IF	PSON8	= Off	GOTO	10
							07	WAITFOR	PSSR8A	= OPEN		
							08	IF	PSSR8A	= CLOSE	GOTO	12
							09	IF	PSSR8B	= CLOSE	GOTO	12
							10	OPEN	MAGAL2			
							11	GOTO	0			
							12	CLOSE	MAGAL2			
							13	GOTO	0			
							14	NUL				
							15	NUL				
							16	NUL				
							17	NUL				
							18	NUL				
							19	NUL				

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TAG      AD_ AP ST_SCA IS_IN IA_I DESC                                 PROGRAM
-------  --- -- ------ ----- ---- ------------------------------------ ------------------------------------------------
PSALPG6  TH  L  3:2    ON    AUTO Power Supply Setpoint Alarm          00  MAXWAIT  20
                                                                       01  NUL
                                                                       02  IF       PSON11    = Off    GOTO 6
                                                                       03  WAITFOR  PSSR11A   = OPEN
                                                                       04  IF       PSSR11A   = CLOSE  GOTO 12
                                                                       05  IF       PSSR11B   = CLOSE  GOTO 12
                                                                       06  IF       PSON12    = Off    GOTO 10
                                                                       07  WAITFOR  PSSR12A   = OPEN
                                                                       08  IF       PSSR12A   = CLOSE  GOTO 12
                                                                       09  IF       PSSR12B   = CLOSE  GOTO 12
                                                                       10  OPEN     CARAL2
                                                                       11  GOTO     0
                                                                       12  CLOSE    CARAL2
                                                                       13  GOTO     0
                                                                       14  NUL
                                                                       15  NUL
                                                                       16  NUL
                                                                       17  NUL
                                                                       18  NUL
                                                                       19  NUL

PSALPG7  TH  L  3      ON    AUTO Power Supply Setpoint Alarm          00  MAXWAIT  20
                                                                       01  NUL
                                                                       02  IF       PSON1     = Off    GOTO 6
                                                                       03  WAITFOR  PSARC1A   = OPEN
                                                                       04  IF       PSARC1A   = OPEN   GOTO 12
                                                                       05  IF       PSARC1B   = OPEN   GOTO 12
                                                                       06  IF       PSON2     = Off    GOTO 10
                                                                       07  WAITFOR  PSARC2A   = OPEN
                                                                       08  IF       PSARC2A   = OPEN   GOTO 12
                                                                       09  IF       PSARC2B   = OPEN   GOTO 12
                                                                       10  OPEN     CHARC1
                                                                       11  GOTO     0
                                                                       12  CLOSE    CHARC1
                                                                       13  GOTO     0
                                                                       14  NUL
                                                                       15  NUL
                                                                       16  NUL
                                                                       17  NUL
                                                                       18  NUL
                                                                       19  NUL
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TAG	AD_	AP	ST_SCA	IS_IN	IA_I	DESC	PROGRAM				
PSALPG8	TH	L	3:1	ON		AUTO Power Supply Setpoint Alarm	00	MAXWAIT	20		
							01	NUL			
							02	IF	PSON5	= Off	GOTO 6
							03	WAITFOR	PSARC5A	= OPEN	
							04	IF	PSARC5A	= OPEN	GOTO 12
							05	IF	PSARC5B	= OPEN	GOTO 12
							06	IF	PSON6	= Off	GOTO 10
							07	WAITFOR	PSARC6A	= OPEN	
							08	IF	PSARC6A	= OPEN	GOTO 12
							09	IF	PSARC6B	= OPEN	GOTO 12
							10	OPEN	MGARC1		
							11	GOTO	0		
							12	CLOSE	MGARC1		
							13	GOTO	0		
							14	NUL			
							15	NUL			
							16	NUL			
							17	NUL			
							18	NUL			
							19	NUL			
PSALPG9	TH	L	3:2	ON		AUTO Power Supply Setpoint Alarm	00	MAXWAIT	20		
							01	NUL			
							02	IF	PSON9	= Off	GOTO 6
							03	WAITFOR	PSARC9A	= OPEN	
							04	IF	PSARC9A	= OPEN	GOTO 12
							05	NUL			
							06	IF	PSON10	= Off	GOTO 10
							07	WAITFOR	PSARC10A	= OPEN	
							08	IF	PSARC10A	= OPEN	GOTO 12
							09	IF	PSARC10B	= OPEN	GOTO 12
							10	OPEN	CAARC1		
							11	GOTO	0		
							12	CLOSE	CAARC1		
							13	GOTO	0		
							14	NUL			
							15	NUL			
							16	NUL			
							17	NUL			
							18	NUL			
							19	NUL			

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TAG	AD_	AP	ST_SCA	IS_IN	IA_I	DESC	PROGRAM
PSFPG1	TH	L	6	ON		AUTO Change PFS Value	00 1 != Off GOTO 3
							01 SETOUT PSF1 1
							02 GOTO 4
							03 SETOUT PSF1 2
							04 2 != Off GOTO 7
							05 SETOUT PSF2 1
							06 GOTO 8
							07 SETOUT PSF2 2
							08 3 != Off GOTO 11
							09 SETOUT PSF3 1
							10 GOTO 12
							11 SETOUT PSF3 2
							12 4 != Off GOTO 15
							13 SETOUT PSF4 1
							14 GOTO 0
							15 SETOUT PSF4 2
							16 GOTO 0
							17 NUL
							18 NUL
							19 NUL
PSFPG2	TH	L	6:2	ON		AUTO Change PFS Value	00 5 != Off GOTO 3
							01 SETOUT PSF5 1
							02 GOTO 4
							03 SETOUT PSF5 2
							04 6 != Off GOTO 7
							05 SETOUT PSF6 1
							06 GOTO 8
							07 SETOUT PSF6 2
							08 7 != Off GOTO 11
							09 SETOUT PSF7 1
							10 GOTO 12
							11 SETOUT PSF7 2
							12 8 != Off GOTO 15
							13 SETOUT PSF8 1
							14 GOTO 0
							15 SETOUT PSF8 2
							16 GOTO 0
							17 NUL
							18 NUL
							19 NUL

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TAG	AD_	AP	ST_SCA	IS_IN	IA_I	DESC	PROGRAM
PSFPG3	TH	L	6:4	ON	AUTO	Change PFS Value	00 9 != Off GOTO 3
							01 SETOUT PSF9 1
							02 GOTO 4
							03 SETOUT PSF9 2
							04 10 != Off GOTO 7
							05 SETOUT PSF10 1
							06 GOTO 8
							07 SETOUT PSF10 2
							08 11 != Off GOTO 11
							09 SETOUT PSF11 1
							10 GOTO 12
							11 SETOUT PSF11 2
							12 12 != Off GOTO 15
							13 SETOUT PSF12 1
							14 GOTO 0
							15 SETOUT PSF12 2
							16 GOTO 0
							17 NUL
							18 NUL
							19 NUL
PSVI1	TH	L	3	ON	AUTO	Power Supply Vacuum Interlock - Chrome	00 IF TC6 = OPEN GOTO 5
							01 IF PSIV1 = CLOSE GOTO 0
							02 CLOSE PSIV1
							03 CLOSE PSIV2
							04 GOTO 0
							05 IF PSIV1 = OPEN GOTO 0
							06 OPEN PSIV1
							07 OPEN PSIV2
							08 GOTO 0
							09 NUL
							10 NUL
							11 NUL
							12 NUL
							13 NUL
							14 NUL
							15 NUL
							16 NUL
							17 NUL
							18 NUL
							19 NUL

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TAG	AD_	AP	ST_SCA	IS_IN	IA_I	DESC	PROGRAM			
PSVI2	TH	L	3:1	ON	AUTO	Power Supply Vacuum Interlock - Mag	00	IF	TC11	= OPEN GOTO 5
							01	IF	PSIV3	= CLOSE GOTO 0
							02	CLOSE	PSIV3	
							03	CLOSE	PSIV4	
							04	GOTO	0	
							05	IF	PSIV3	= OPEN GOTO 0
							06	OPEN	PSIV3	
							07	OPEN	PSIV4	
							08	GOTO	0	
							09	NUL		
							10	NUL		
							11	NUL		
							12	NUL		
							13	NUL		
							14	NUL		
							15	NUL		
							16	NUL		
							17	NUL		
							18	NUL		
							19	NUL		
PSVI3	TH	L	3:2	ON	AUTO	Power Supply Vacuum Interlock - Carbon	00	IF	TC16	= OPEN GOTO 5
							01	IF	PSIV5	= CLOSE GOTO 0
							02	CLOSE	PSIV5	
							03	CLOSE	PSIV6	
							04	GOTO	0	
							05	IF	PSIV5	= OPEN GOTO 0
							06	OPEN	PSIV5	
							07	OPEN	PSIV6	
							08	GOTO	0	
							09	NUL		
							10	NUL		
							11	NUL		
							12	NUL		
							13	NUL		
							14	NUL		
							15	NUL		
							16	NUL		
							17	NUL		
							18	NUL		
							19	NUL		

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TAG	AD_	AP	ST_SCA	IS_IN	IA_I	DESC	PROGRAM				
RCPPG	TH	L	3		ON	AUTO Select Recipe to Load	00	IF	SELRCP1	!= CLOSE	GOTO 2
							01	SETOUT	RCPREG	1	
							02	IF	SELRCP2	!= CLOSE	GOTO 4
							03	SETOUT	RCPREG	2	
							04	IF	SELRCP3	!= CLOSE	GOTO 6
							05	SETOUT	RCPREG	3	
							06	IF	SELRCP4	!= CLOSE	GOTO 0
							07	SETOUT	RCPREG	4	
							08	GOTO	0		
							09	NUL			
							10	NUL			
							11	NUL			
							12	NUL			
							13	NUL			
							14	NUL			
							15	NUL			
							16	NUL			
							17	NUL			
							18	NUL			
							19	NUL			
TD1PROG	TH	L	3:1		ON	AUTO Cryo #1 Temperature Select	00	IF	TD1	<=	2.22 GOTO 4
							01	SETOUT	85		
							02	SETOUT	63		
							03	GOTO	6		
							04	SETOUT	58		
							05	SETOUT	00		
							06	IF	TD2	<=	2.22 GOTO 10
							07	SETOUT	85		
							08	SETOUT	63		
							09	GOTO	12		
							10	SETOUT	58		
							11	SETOUT	00		
							12	IF	TD3	<=	2.22 GOTO 16
							13	SETOUT	85		
							14	SETOUT	63		
							15	GOTO	0		
							16	SETOUT	58		
							17	SETOUT	00		
							18	GOTO	0		
							19	NUL			

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TAG	AD_	AP	ST_SCA	IS_IN	IA_I	DESC	PROGRAM				
-------	---	--	------	-----	----	----------	--				
TD2PROG	TH	L	3:2	ON	AUTO	Cryo #1 Temperature Select	00	IF	TD4	<=	2.22 GOTO 4
							01	SETOUT	85		
							02	SETOUT	63		
							03	GOTO	6		
							04	SETOUT	58		
							05	SETOUT	00		
							06	IF	TD5	<=	2.22 GOTO 10
							07	SETOUT	85		
							08	SETOUT	63		
							09	GOTO	12		
							10	SETOUT	58		
							11	SETOUT	00		
							12	IF	TD6	<=	2.22 GOTO 16
							13	SETOUT	85		
							14	SETOUT	63		
							15	GOTO	0		
							16	SETOUT	58		
							17	SETOUT	00		
							18	GOTO	0		
							19	NUL			
TD3PROG	TH	L	3	ON	AUTO	Cryo 3 Temperature Select	00	IF	TD7	<=	2.22 GOTO 4
							01	SETOUT	85		
							02	SETOUT	63		
							03	GOTO	6		
							04	SETOUT	58		
							05	SETOUT	00		
							06	IF	TD8	<=	2.22 GOTO 10
							07	SETOUT	85		
							08	SETOUT	63		
							09	GOTO	12		
							10	SETOUT	58		
							11	SETOUT	00		
							12	IF	TD9	<=	2.22 GOTO 16
							13	SETOUT	85		
							14	SETOUT	63		
							15	GOTO	0		
							16	SETOUT	58		
							17	SETOUT	00		
							18	GOTO	0		
							19	NUL			

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TAG	AD_	AP	ST_SCA	IS_IN	IA_I	DESC
TD4PROG	TH	L	3:1	ON		AUTO Cryo 4 Temperature Select

PROGRAM

00	IF	TD10	<=	2.22 GOTO 4
01	SETOUT	85		
02	SETOUT	63		
03	GOTO	6		
04	SETOUT	58		
05	SETOUT	00		
06	IF	TD11	<=	2.22 GOTO 10
07	SETOUT	58		
08	SETOUT	63		
09	GOTO	12		
10	SETOUT	58		
11	SETOUT	00		
12	IF	TD12	<=	2.22 GOTO 16
13	SETOUT	85		
14	SETOUT	63		
15	GOTO	0		
16	SETOUT	58		
17	SETOUT	00		
18	GOTO	0		
19	NUL			

```
                                                        CY11TMP20   CY12TMP20   TEMP21
                                                           B3          B3         B3
------                                                 ---] [-------] [--------( )---
GOTO 4                                                     511         512        21
```

Rung #022

```
      |PALLET     PALLET      PALLET     PALLET     PALLET     PALLET     PALLET     PALLET     PALLET     PALLET     PALLET
      |DETECTED   DETECTED    DETECTED   DETECTED   DETECTED   DETECTED   DETECTED   DETECTED   DETECTED   DETECTED   DETECTED
      |LEFT SIDE  RIGHT SIDE  LEFT SIDE  LEFT SIDE  LEFT SIDE  LEFT SIDE  LEFT SIDE  LEFT SIDE  LEFT SIDE  LEFT SIDE  LEFT SIDE
      |ENTRANCE   ENTRANCE    HEATER 1   HEATER 2   DWELL 1    CHROME     DWELL 2    HEATER 3   DWELL 3    MAGNETIC   DWELL 4
GOTO 1|SEN1       SEN3        SEN7       SEN10      SEN13      SEN16      SEN19      SEN22      SEN25      SEN28      SEN31
      |  I:003      I:003       I:003      I:003      I:003      I:023      I:023      I:023      I:023      I:037      I:037
      |---] [------] [---------] [--------] [--------] [--------] [--------] [--------] [--------] [--------] [--------] [---
      |   00         02          06         11         14         00         03         06         11         00         03
                                                                          PALLET     PALLET     PALLET     PALLET
                                                                          DETECTED   DETECTED   DETECTED   DETECTED
GOTO 1                                                                    LEFT SIDE  LEFT SIDE  LEFT SIDE  LEFT SIDE
                                                                          BUFFER 3   DWELL 5    CARBON     DWELL 6    TEMP
                                                                          SEN34      SEN37      SEN40      SEN43      TEMP16
                                                                            I:037      I:037      I:053      I:053      B3
                                                                          ---] [--------] [--------] [--------] [-----( )---
                                                                              06         11         00         03       16
```

B3/16 - -( )- - File #6 TECH_RUNGS - 18

Rung #023

```
|PALLET     PALLET     PALLET     PALLET     PALLET
|DETECTED   DETECTED   DETECTED   DETECTED   DETECTED
|LEFT SIDE  LEFT SIDE  LEFT SIDE  LEFT SIDE  RIGHT SIDE
|BUFFER 4   EXBUFFER   EXIT LOCK  EXIT END   EXIT END
|SEN46      SEN49      SEN52      SEN55      SEN57
|  I:053      I:053      I:053      I:053      I:054                                        B3
|---] [--------] [--------] [--------] [--------] [----------------------------------------( )-|
|   06         11         14         17         17                                          17
```

Rung #024

```
|                                                                   RETURN FROM
|                                                                   TECH RUNGS
|                                                                   TO MAIN
|                                                                   FROM_TR
|                                                                   +--RET--------+
|-------------------------------------------------------------------|RETURN ()    |-|
|                                                                   +-------------+
```

Rung #025

```
|---------------------------------------------------------------------------[END]-|
```

The apparatus of the present invention provides a high-speed in-line sputtering apparatus for producing superior multilayer films on substrates, such as disks suitable for use in Winchester-type hard disk drives. The process of the present invention provides an improved method of providing multilayer coatings to a variety of substrate types at a much greater rate than prior art methods.

Also described herein are a novel means for heating substrates to be coated, a novel sputtering magnetron design, a novel, variable speed, overhead, non-contaminating substrate transportation system and a comprehensive, centralized, programmable electronic means for controlling the apparatus and process are provided. Still further, when the process and apparatus are used for providing magnetic coatings for substrates, such as disks, to be utilized in hard disk drives using Winchester-type technology, a unique disk texturing method for improving the disk's magnetic recording properties, and a novel disk carrier (or pallet) design which contributes to uniform substrate heating characteristics in a large, single, high capacity pallet, are also provided herein. Numerous variations are possible as will be apparent to those skilled in the art; such variations are intended to be within the scope of the invention as defined by this specification and the following claims are intended to cover all the modifications and equivalents falling within the scope of the invention.

CLAIMS

What is claimed is:

1. A high throughput sputtering apparatus for providing a single or multi-layer coating to the surface of a plurality of substrates, said apparatus including a plurality of buffer and sputtering chambers, and an input end and an output end, wherein said substrates are transported through said chambers of said apparatus at varying rates of speed such that the rate of speed of a pallet from said input end to said output end is a constant for each of said plurality of pallets.

2. A high throughput sputtering apparatus having a plurality of integrally matched components, said components comprising:

means for sputtering a multi-layer coating onto a plurality of substrates, said means for sputtering including a series of sputtering chambers each having relative isolation from adjacent chambers to reduce cross contamination between the coating components being sputtered onto substrates therein, said sputtering chambers being isolated from ambient atmospheric conditions;

means for transporting said plurality of substrates through said means for sputtering at variable velocities;

means for reducing the ambient pressure within said means for sputtering to a vacuum level within a pressure range sufficient to enable sputtering operation;

means for heating said plurality of substrates to a temperature conducive to sputtering said multi-layer coatings thereon, said means for heating providing a

substantially uniform temperature profile over the surface of said substrate; and

control means for providing control signals to, and for receiving feedback input from, said means for sputtering, means for transporting, means for reducing and means for heating, said control means being programmable for allowing control over said means for sputtering, means for transporting, means for reducing and means for heating.

3. A high throughput sputtering apparatus, comprising:

control means for providing control signals and for monitoring a plurality of sensory input signals;

means for transporting a plurality of substrates through a sequential series of concurrent sputtering steps at selected variable velocities responsive to said control signals, said means including a first set of means for providing said sensory input signals to said control means;

means for reducing the ambient pressure within the apparatus to a common reduced pressure level within a pressure range to enable sputtering operation responsive to said control means, said means for reducing including a second set of means for providing said sensory input signals to said control means;

means for heating said plurality of substrates to an ambient temperature, said temperature having a substantially uniform profile over the surface of said substrate, said means for heating including a third set of means for providing said sensory input signals to said control means;

and

means for sputtering a multi-layer coating onto said substrate responsive to said control means, said means for sputtering including a third set of means for providing said sensory input signals to said control means.

4. A high throughput direct current magnetron sputtering process for producing multilayer thin films, comprising the steps of:

providing substrates to be sputtered;

creating an environment about said substrates, said environment having a pressure within a pressure range which would enable sputtering operations;

providing a gas into said environment in a plasma state and within said pressure range to carry out sputtering operations;

transporting substrates at varying velocities through said environment a sequence of sputtering steps within said environment and along a return path external to said environment, and simultaneously

introducing the substrates into said environment without substantially disrupting said pressure of said environment,

providing rapid and uniform heating of said substrates to optimize film integrity during sputtering steps, and

sputtering said substrates to provide successive layers of thin films on the substrates; and

removing the sputtered substrates without contaminating said environment.

688

5. A high throughput direct current sputtering process for producing multilayer thin films on magnetic recording media, comprising the steps of:

providing substrates;

physically abrading the substrates to achieve a uniform texture of intersecting circumferential lines across the substrate surface;

cleaning said substrates;

providing a sputtering environment about said substrates, said environment having a pressure within a pressure range to enable sputtering operations;

loading the substrates into a high capacity carrier of sufficient dimensions to accommodate substrate and carrier thermal expansion and enhance thermal uniformity between individual substrates;

introducing the substrates into said environment without disrupting said environment;

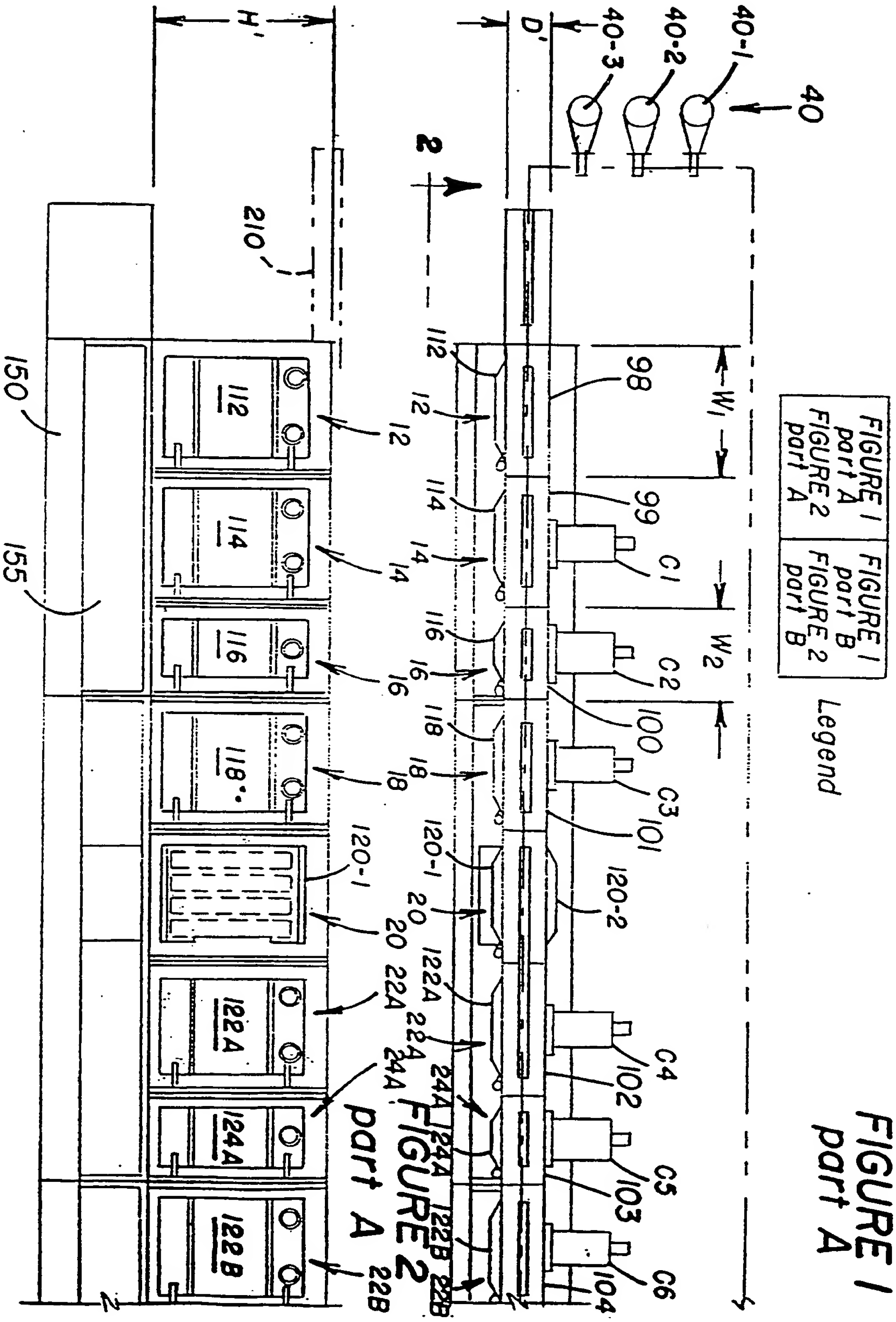
transporting the substrates at varying velocities through said environment a return path external to said environment while protecting substrates from contamination;

providing a gas in a plasma state into said environment at a pressure sufficient to carry out sputtering operations;

providing rapid and uniform heating of the substrates to optimize film integrity during subsequent sputtering steps;

sputtering to provide successive layers of thin films on said substrates; and

removing the coated substrates without disrupting sputtering operations.


Legend
FIGURE 1 part A
FIGURE 2 part A
FIGURE 1 part B
FIGURE 2 part B
40
40-1
40-2
40-3
D'
H'
2
210
98
99
100
101
C1
C2
C3
C4
C5
C6
102
103
104
W1
W2
112
114
116
118
120-1
120-2
122A
124A
122B
12
14
16
18
20
22A
24A
22B
150
155
FIGURE 2 part A
FIGURE 1 part A

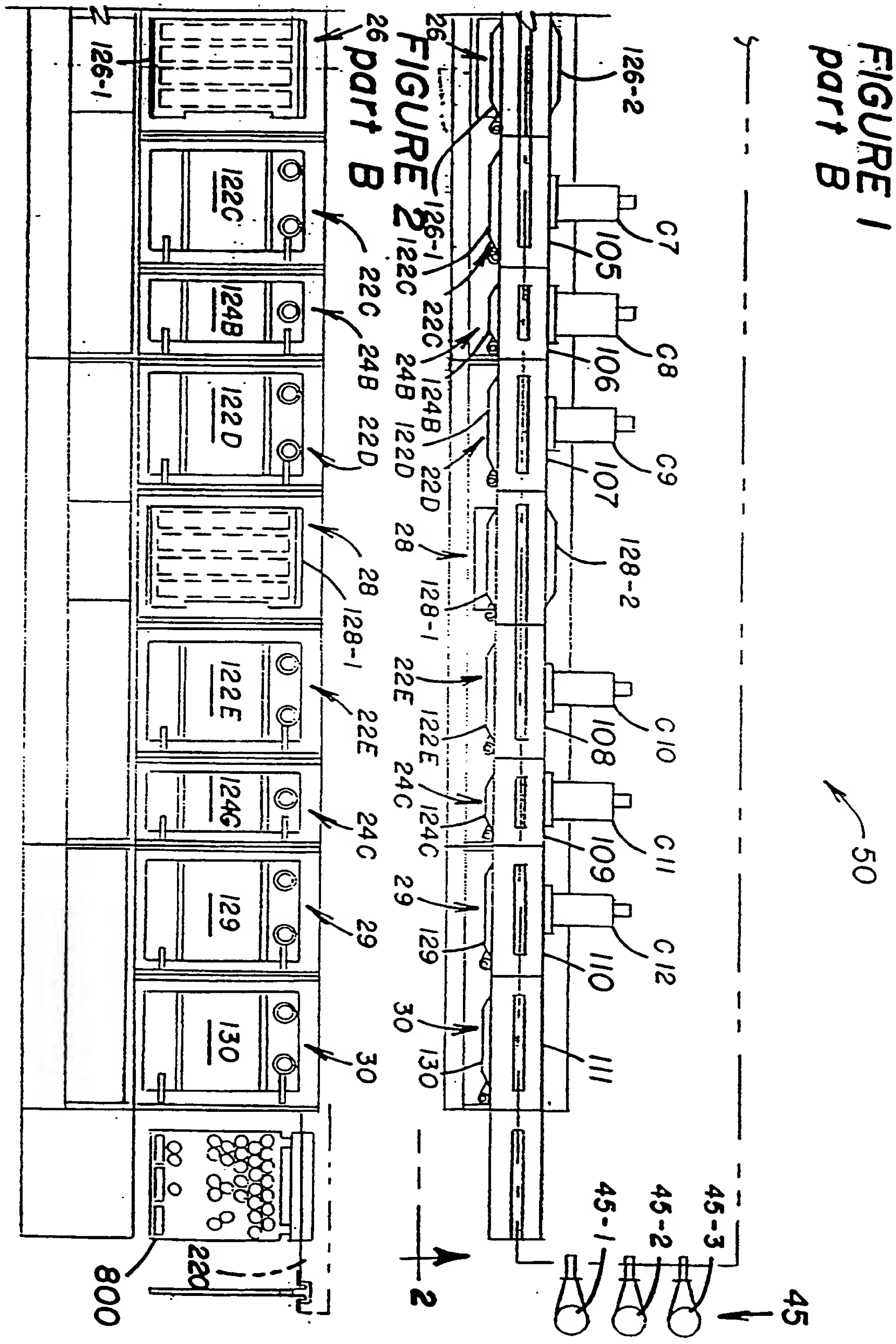


FIGURE 1
part B
FIGURE 2
part B
50
45
45-1
45-2
45-3
126-1
126-2
26
122C
22C
124B
24B
122D
22D
28
128-1
128-2
122E
22E
124C
24C
129
29
130
30
C7
C8
C9
C10
C11
C12
105
106
107
108
109
110
111
800
220
2

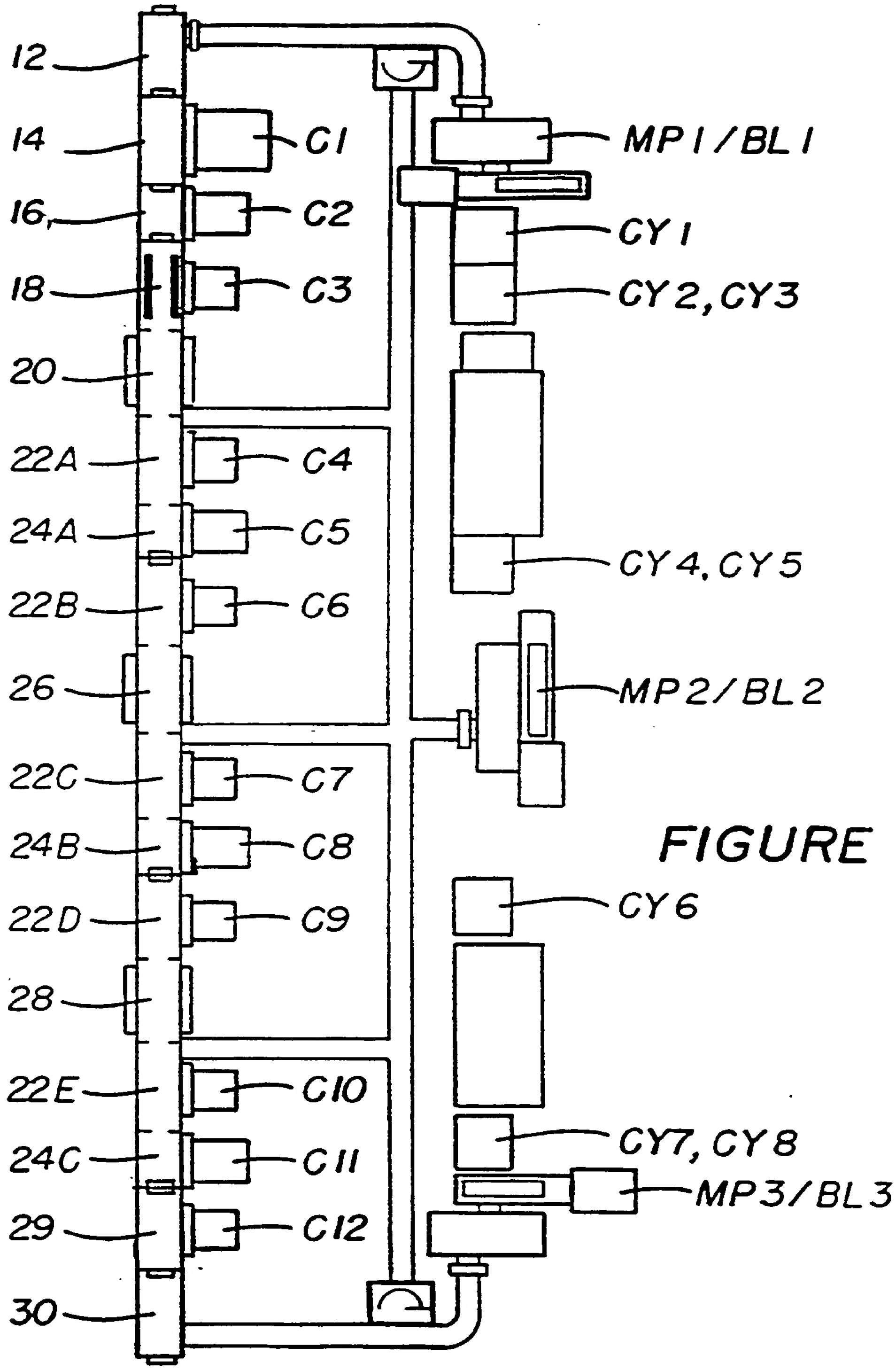
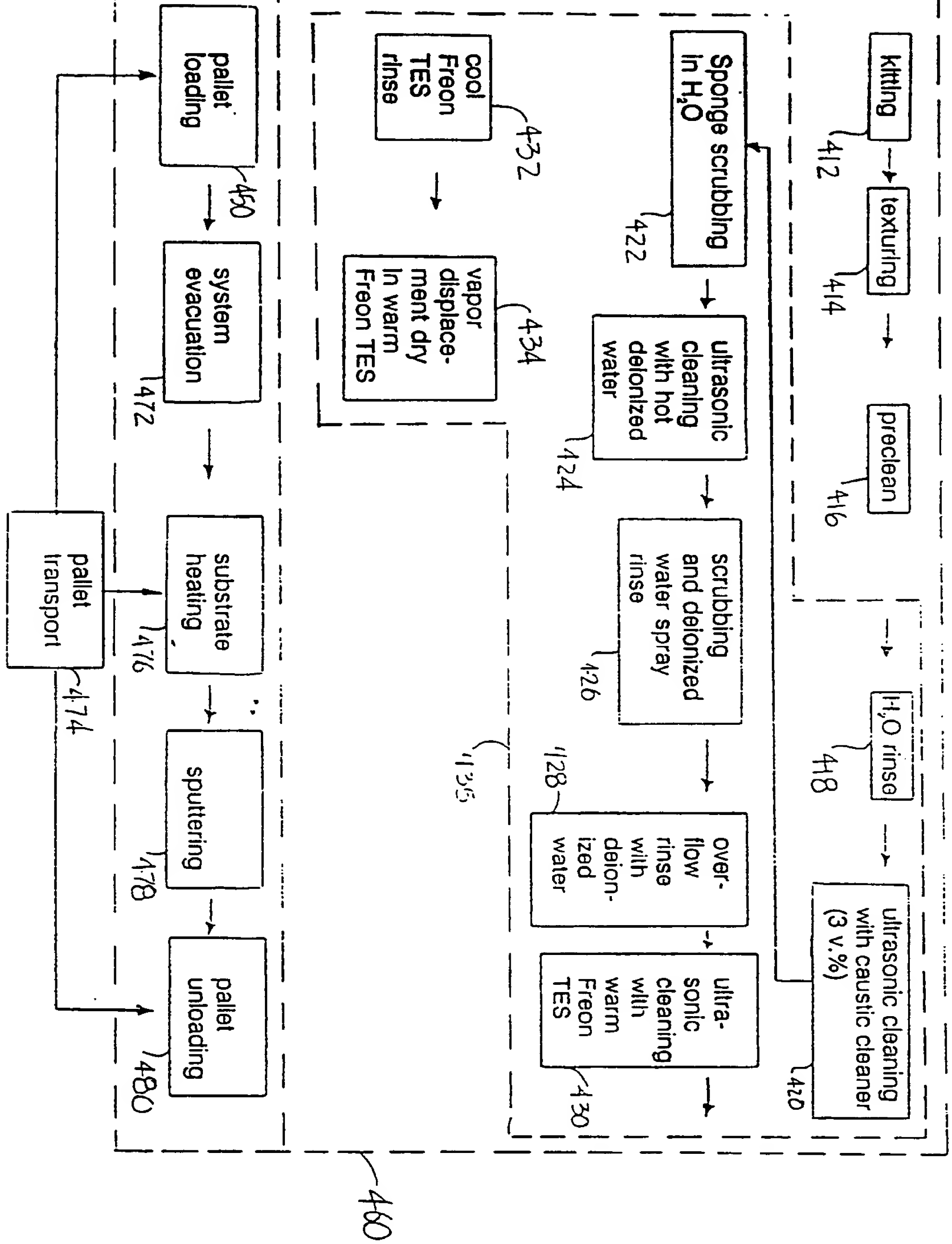

12
14
16
18
20
22A
24A
22B
26
22C
24B
22D
28
22E
24C
29
30
C1
C2
C3
C4
C5
C6
C7
C8
C9
C10
C11
C12
MP1/BL1
CY1
CY2, CY3
CY4, CY5
MP2/BL2
CY6
CY7, CY8
MP3/BL3

FIGURE 3

Figure 4



kitting
412
texturing
414
preclean
416
H_2O rinse
418
ultrasonic cleaning with caustic cleaner (3 v.%)
420
Sponge scrubbing in H_2O
422
ultrasonic cleaning with hot deionized water
424
scrubbing and deionized water spray rinse
426
over-flow rinse with deion-ized water
428
ultra-sonic cleaning with warm Freon TES
430
cool Freon TES rinse
432
vapor displace-ment dry in warm Freon TES
434
pallet loading
450
system evacuation
472
pallet transport
474
substrate heating
476
sputtering
478
pallet unloading
480
460

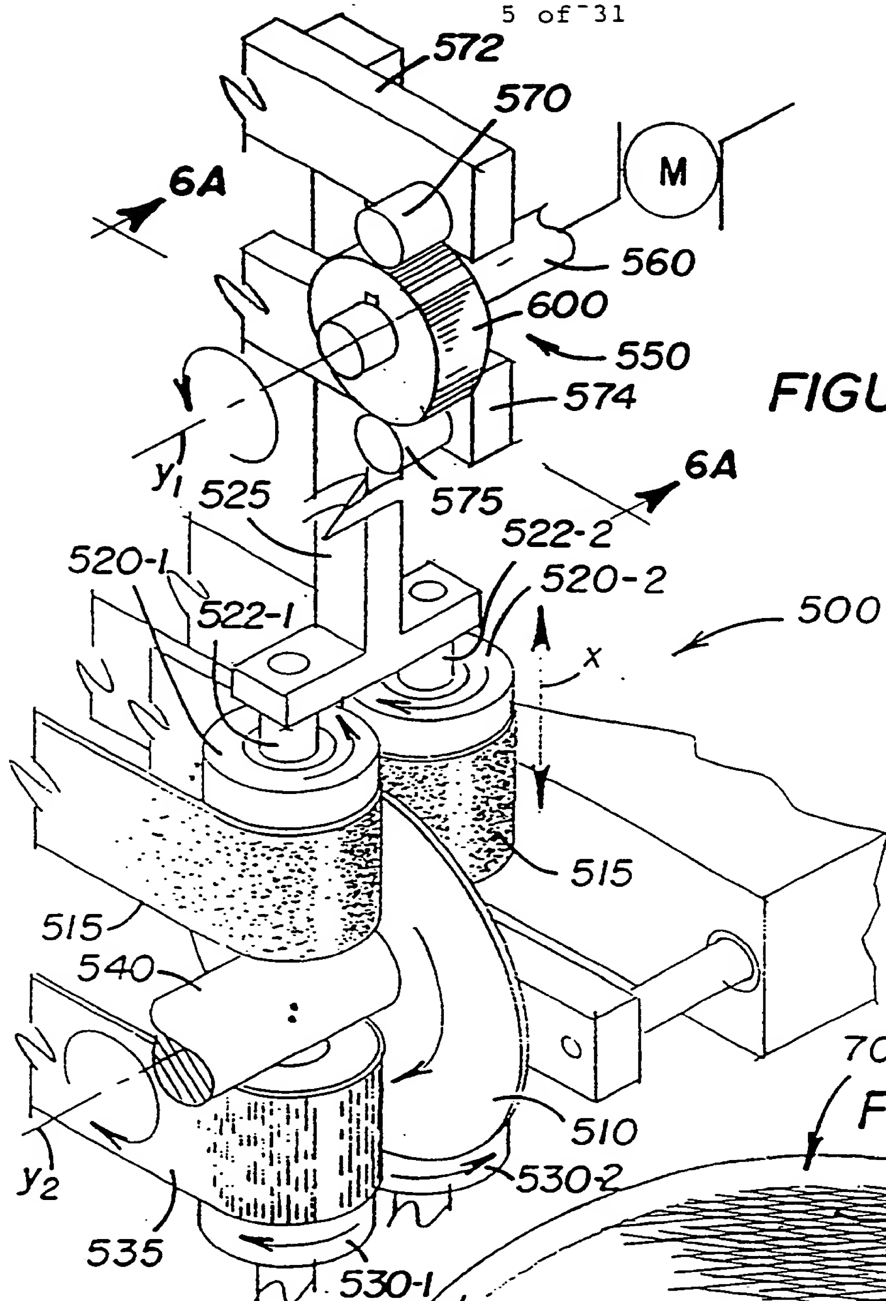


FIGURE 5

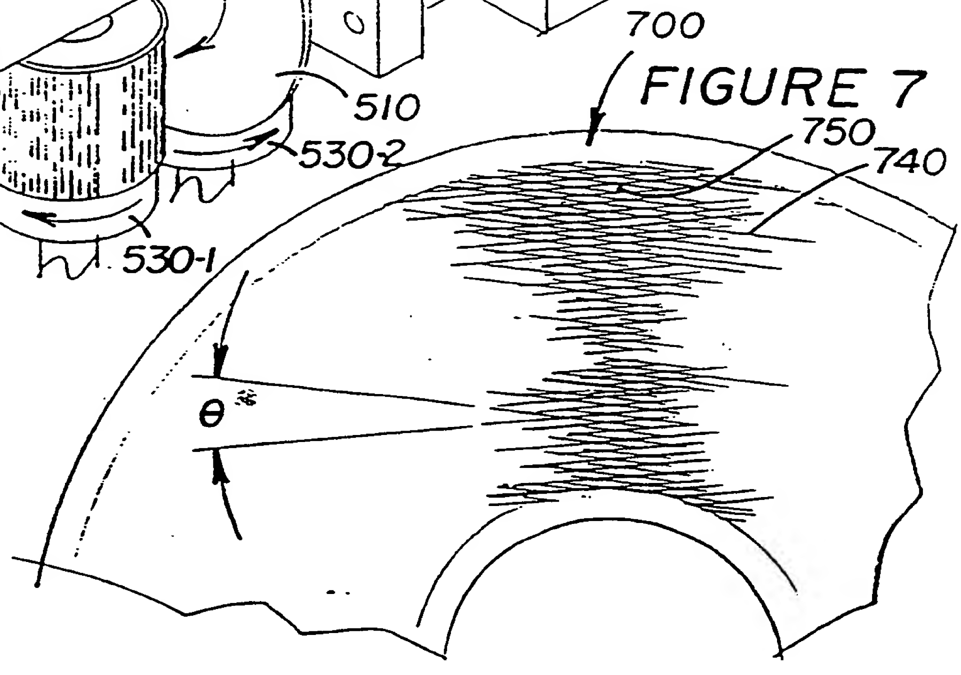


FIGURE 7

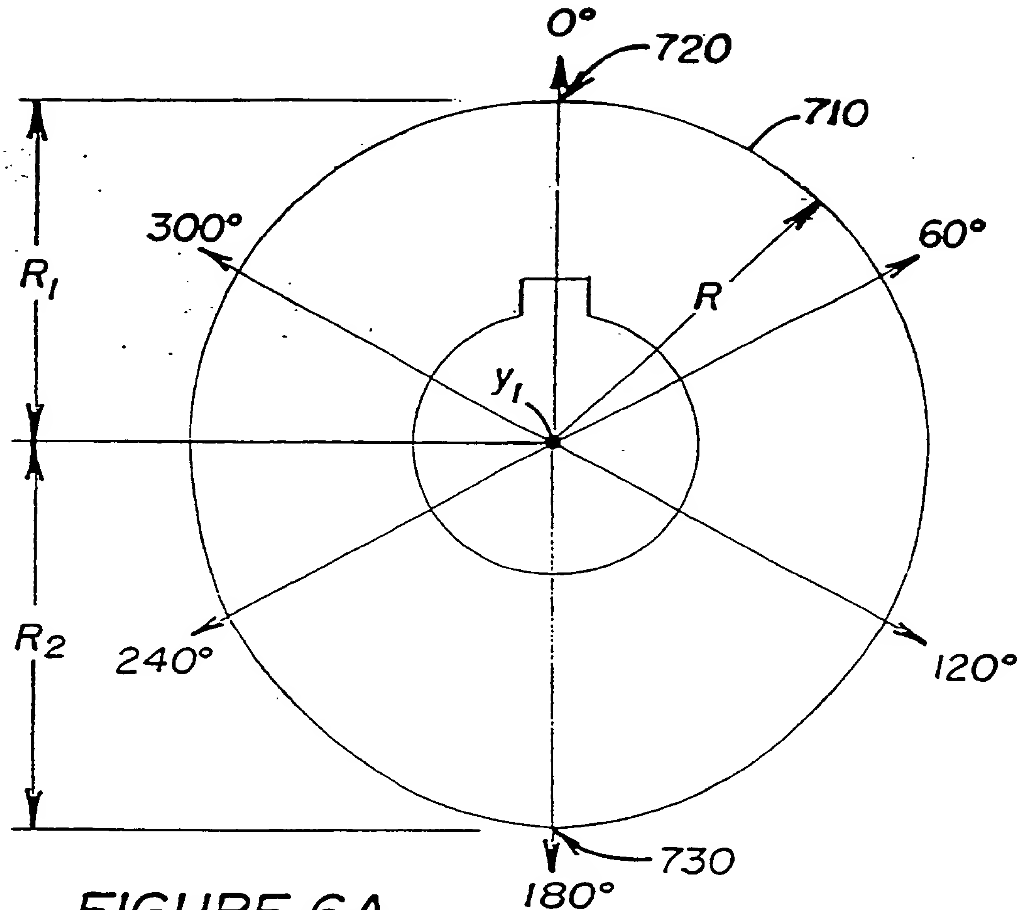


FIGURE 6A

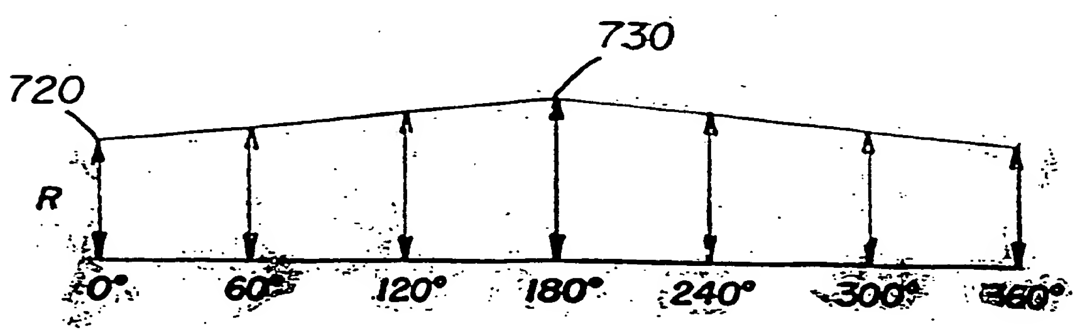


FIGURE 6B

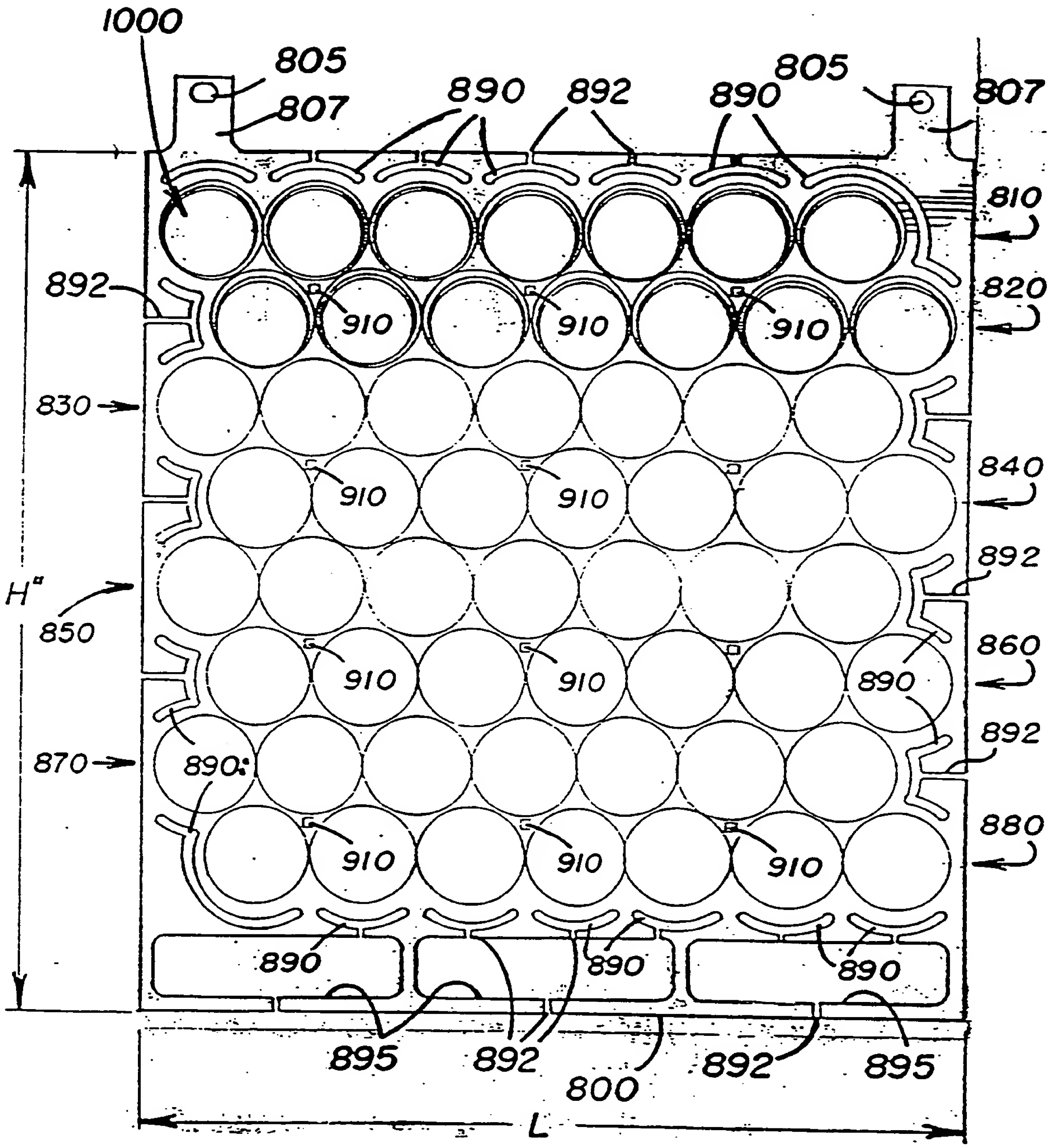

1000
805
807
890
892
890
805
807
810
892
820
910
910
910
830
840
910
910
892
H"
850
860
910
910
890
892
870
890
880
910
910
910
890
890
890
895
892
800
892
895
L

FIGURE 8

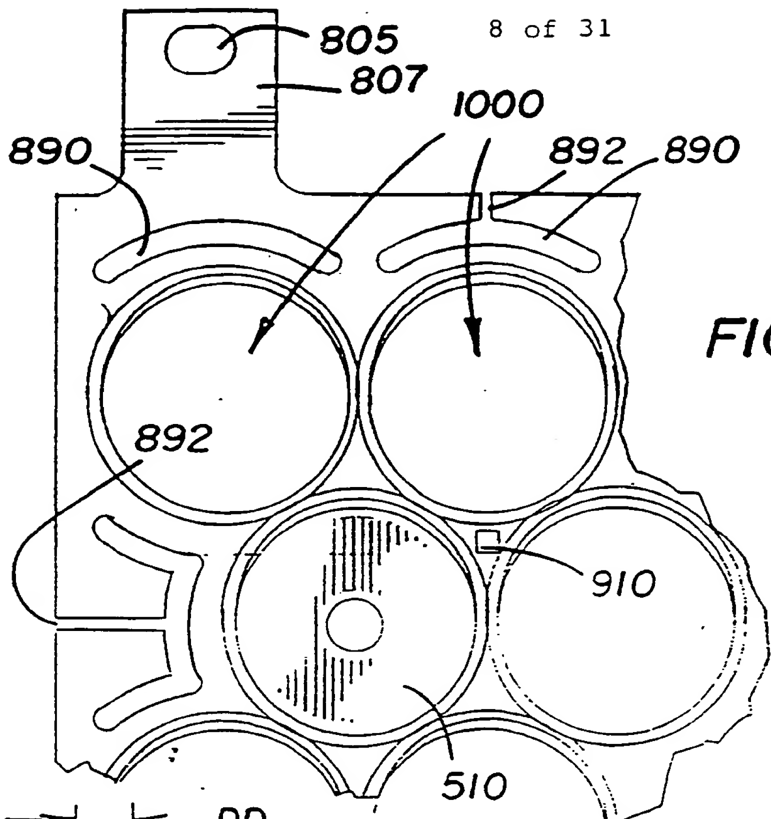


FIGURE 9

FIGURE 10

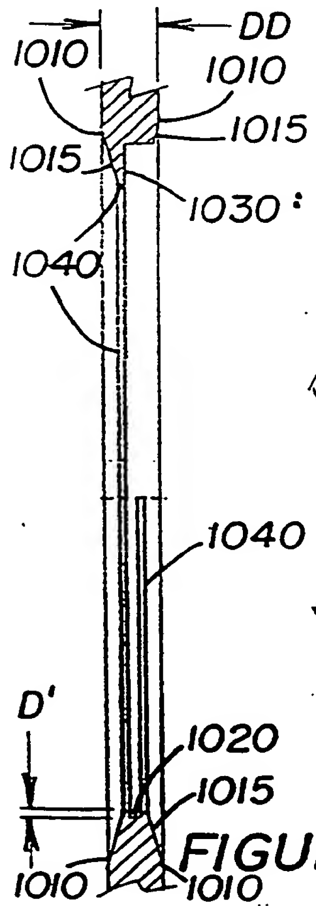
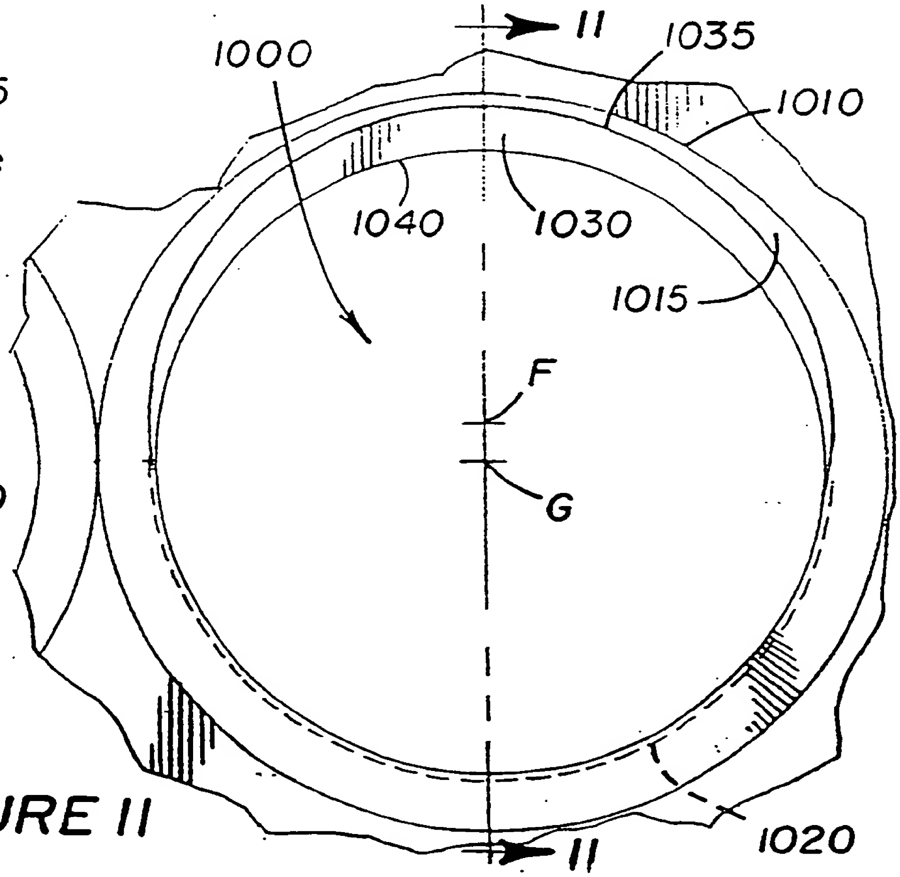


FIGURE 11



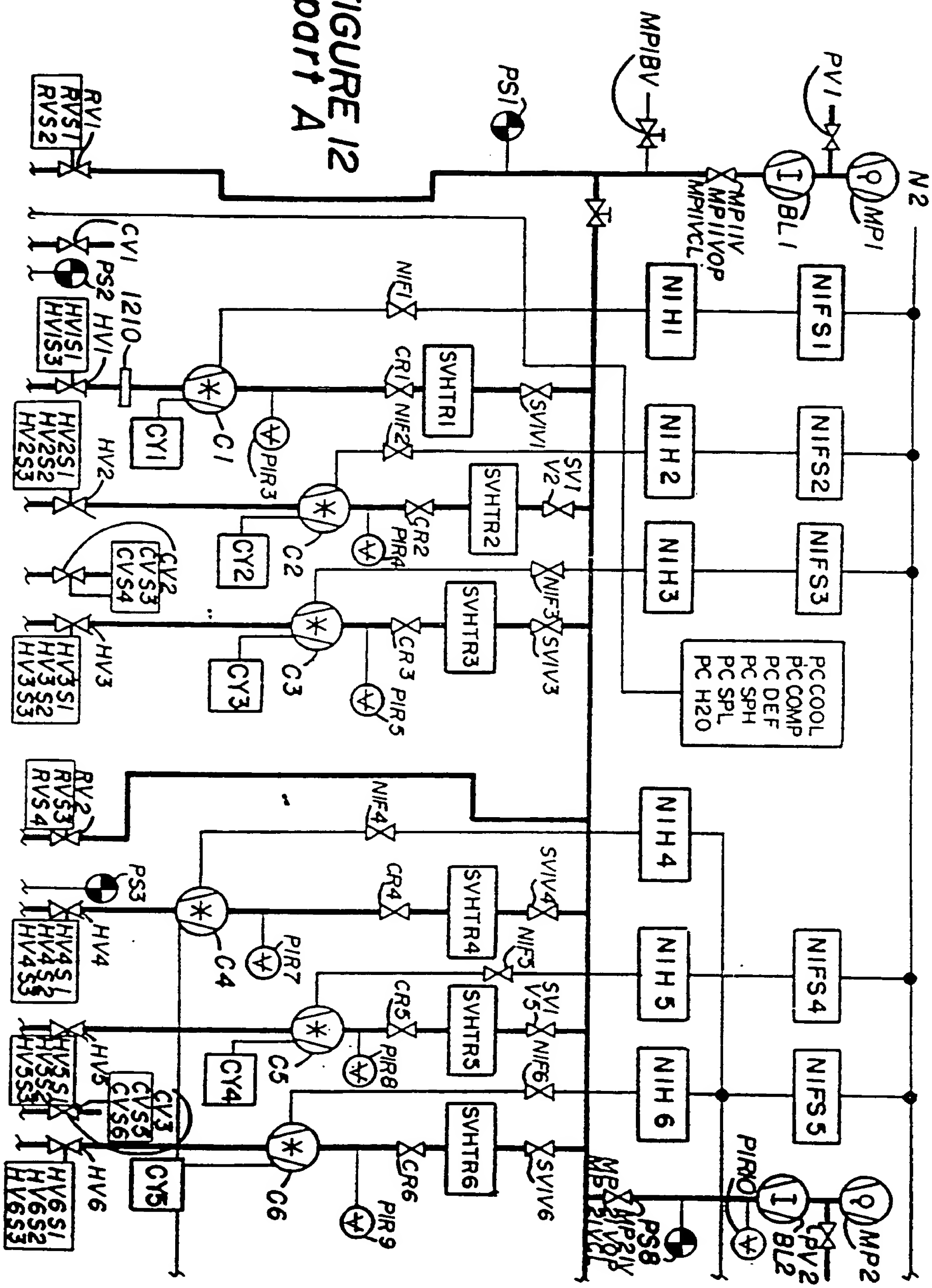


FIGURE 12
part A

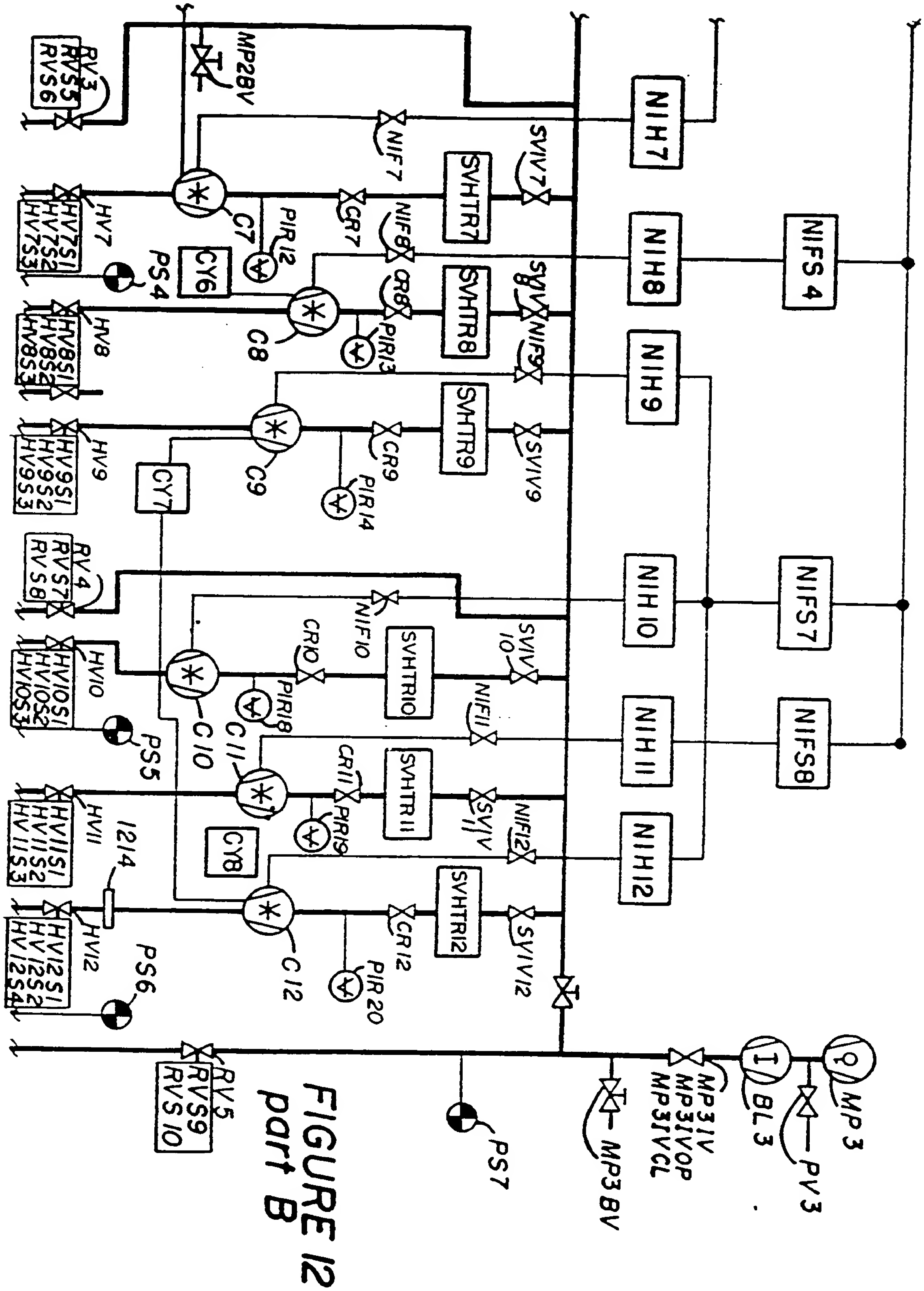


FIGURE 12
part B

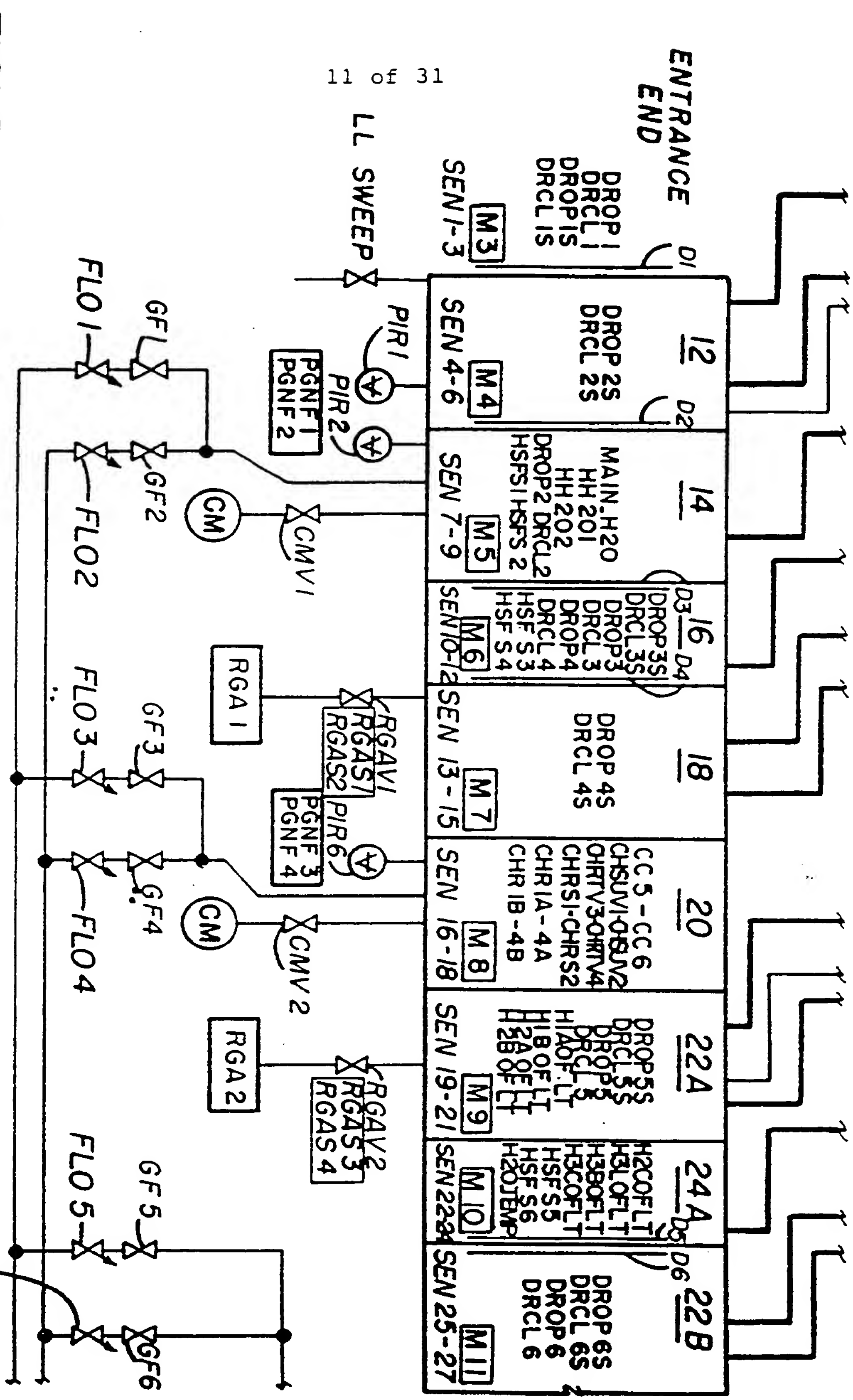


FIGURE 12
part C

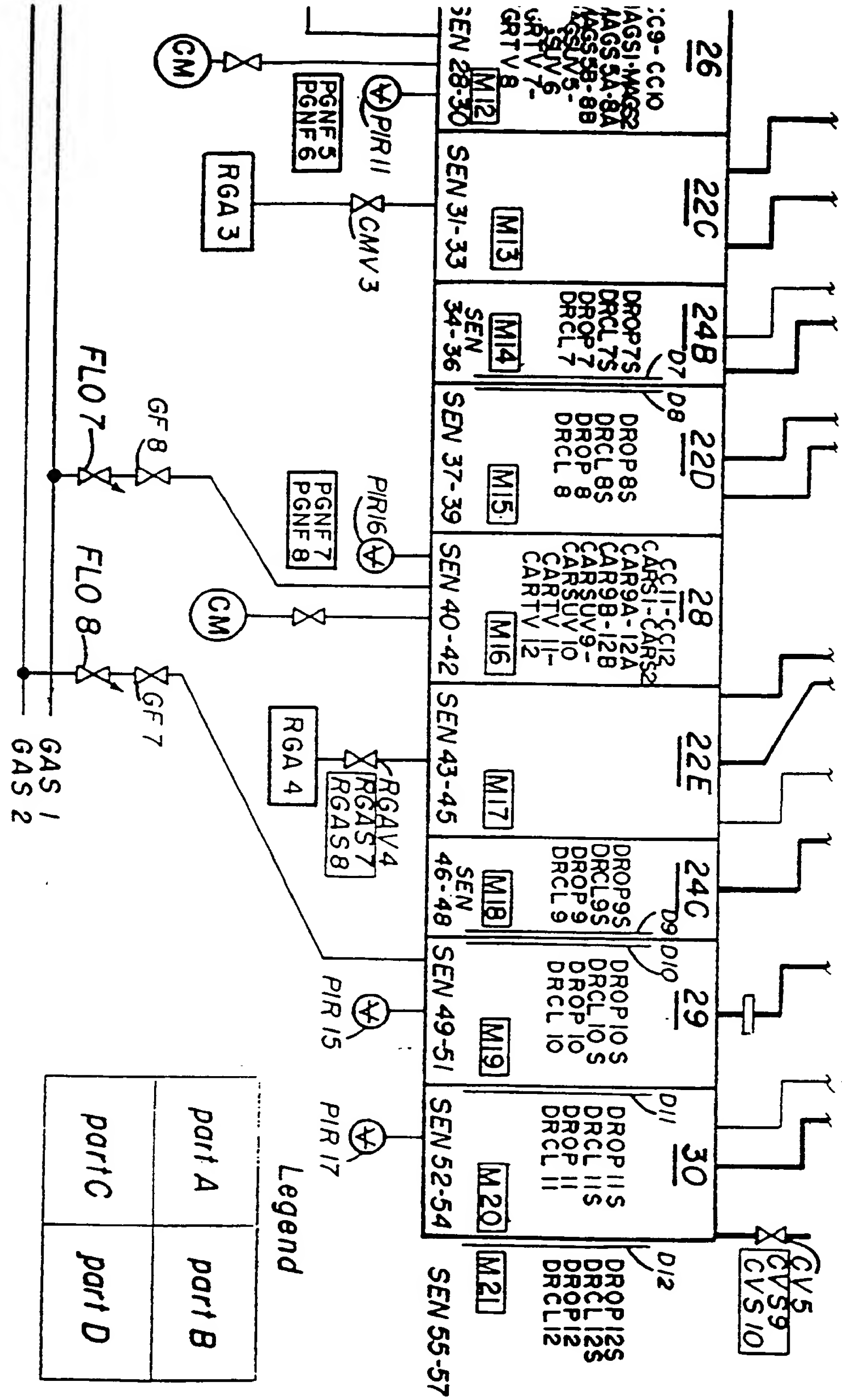


FIGURE 12
part D

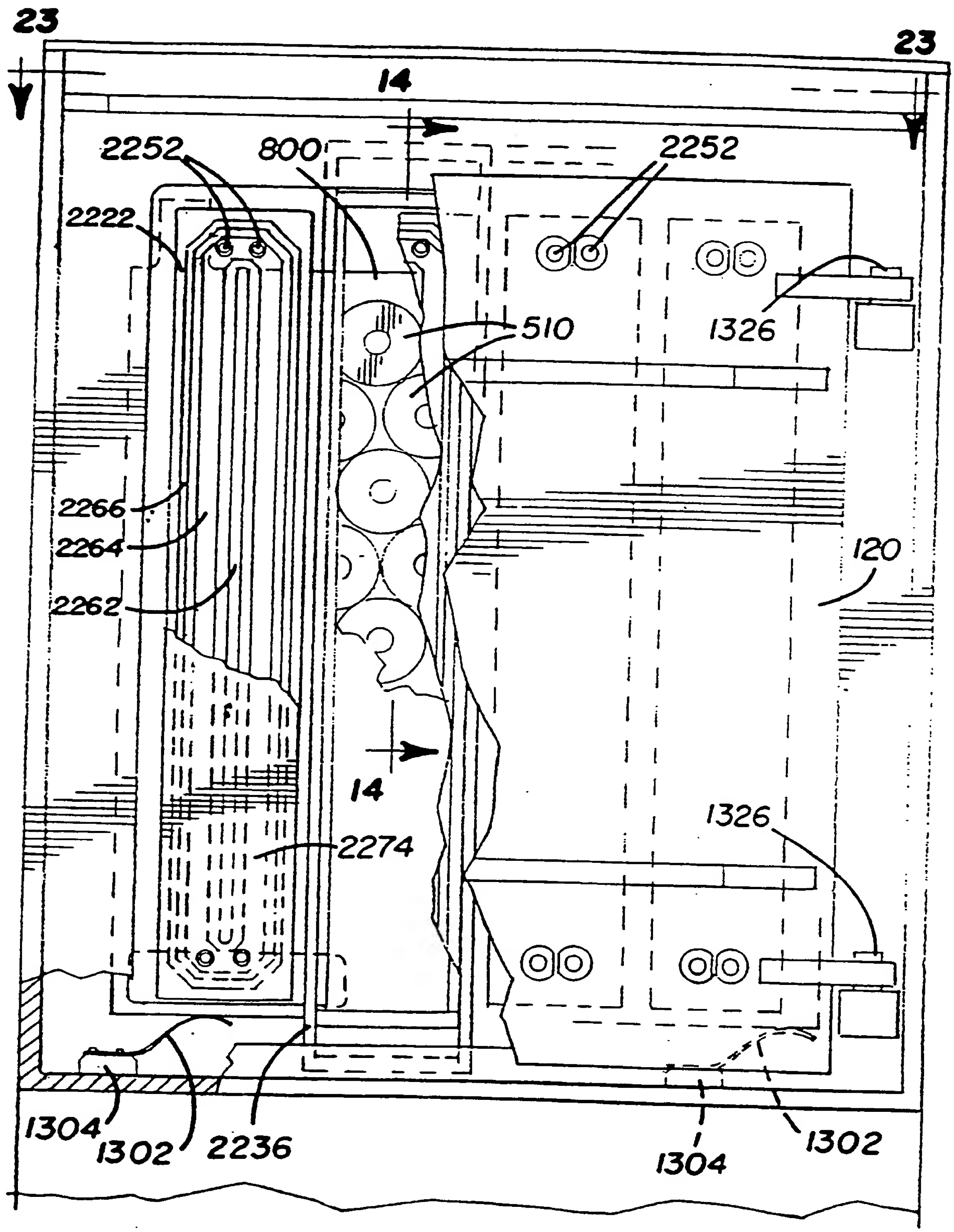

23
23
14
14
2252
800
2252
2222
510
1326
2266
2264
2262
120
1326
2274
1304
1302
2236
1304
1302

FIGURE 13

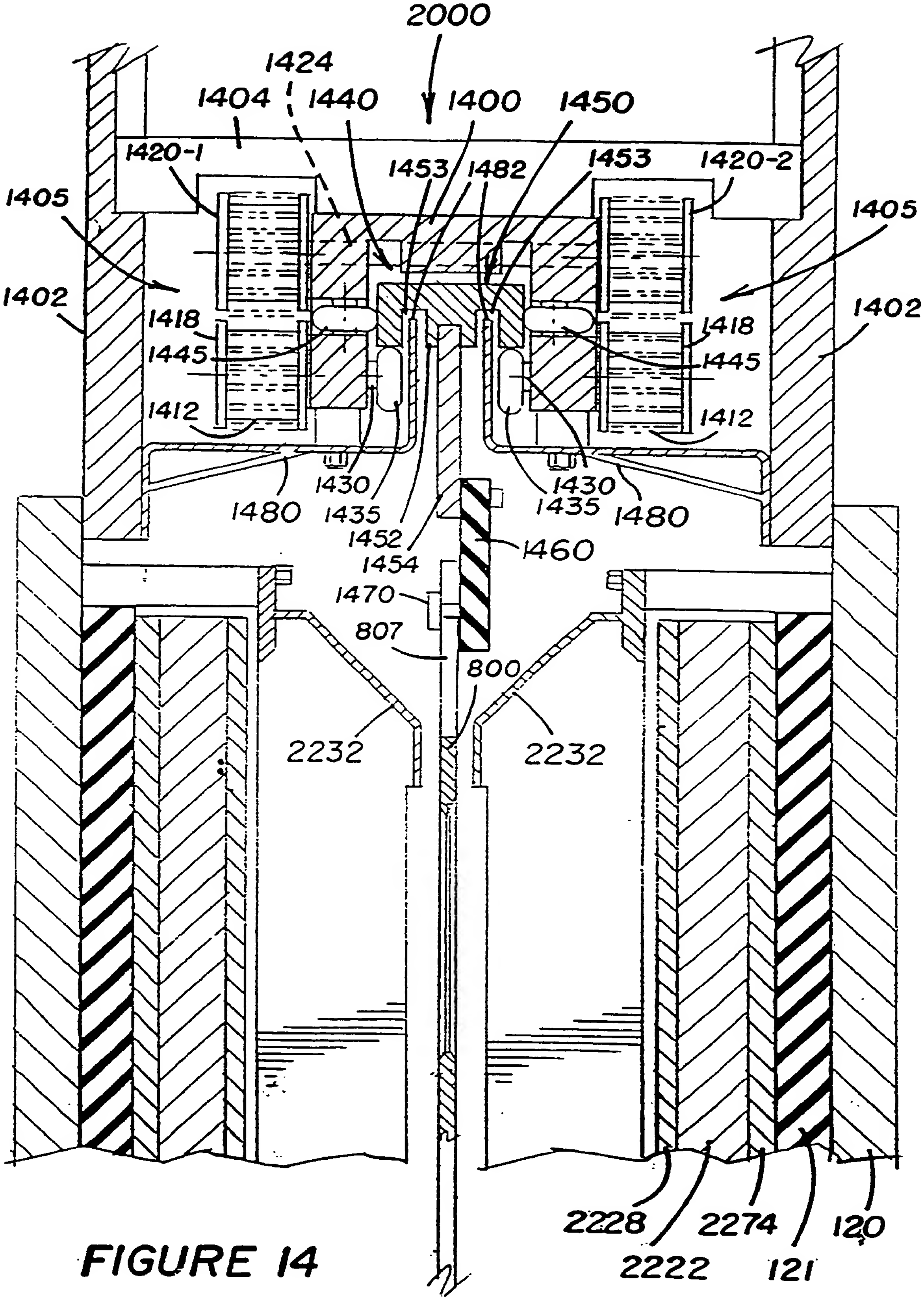

2000
1424
1404
1440
1400
1450
1420-1
1453
1482
1453
1420-2
1405
1405
1402
1402
1418
1418
1445
1445
1412
1412
1430
1430
1480
1435
1435
1480
1452
1454
1460
1470
807
800
2232
2232
2228
2274
120
2222
121

FIGURE 14

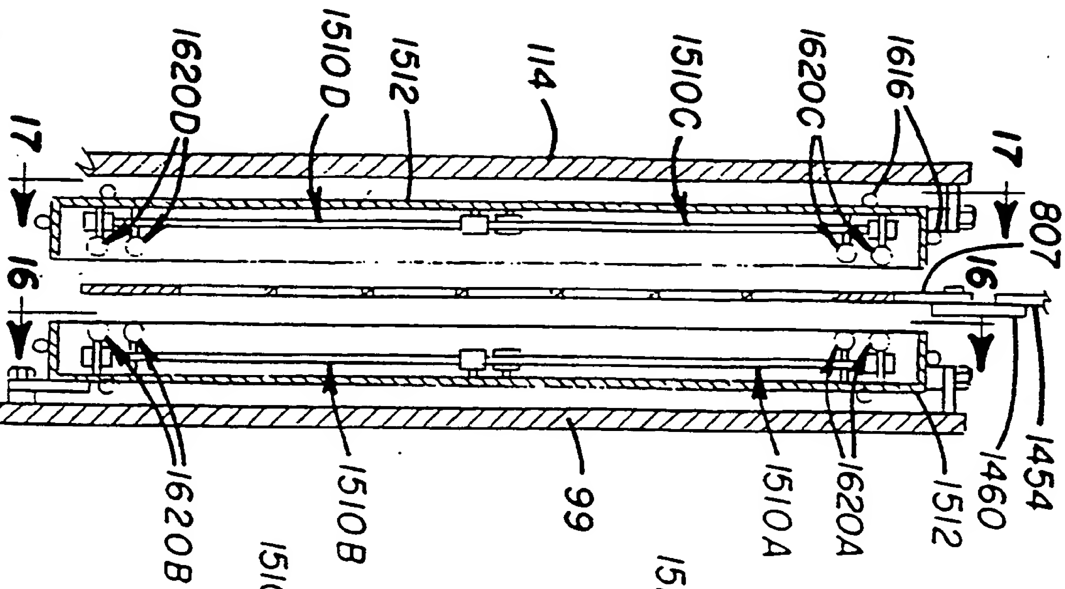


FIGURE 15

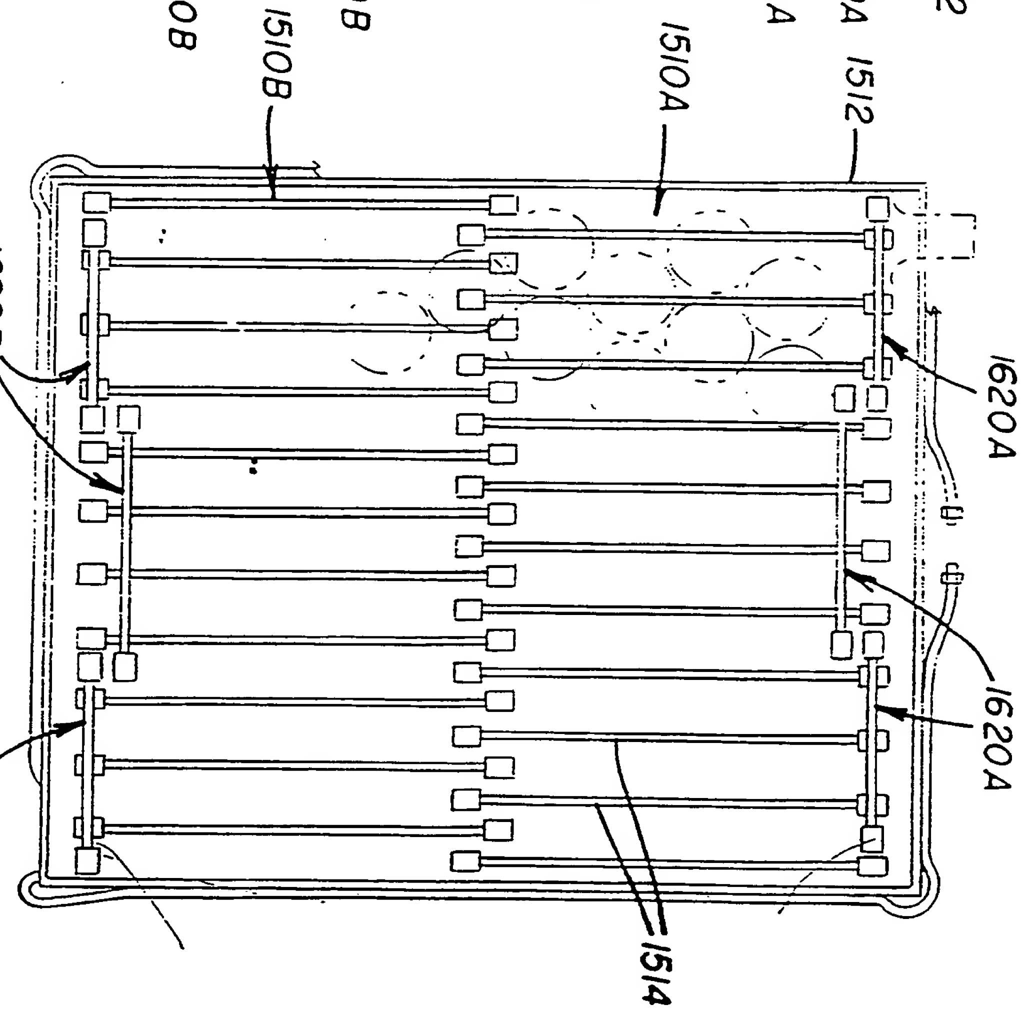


FIGURE 16

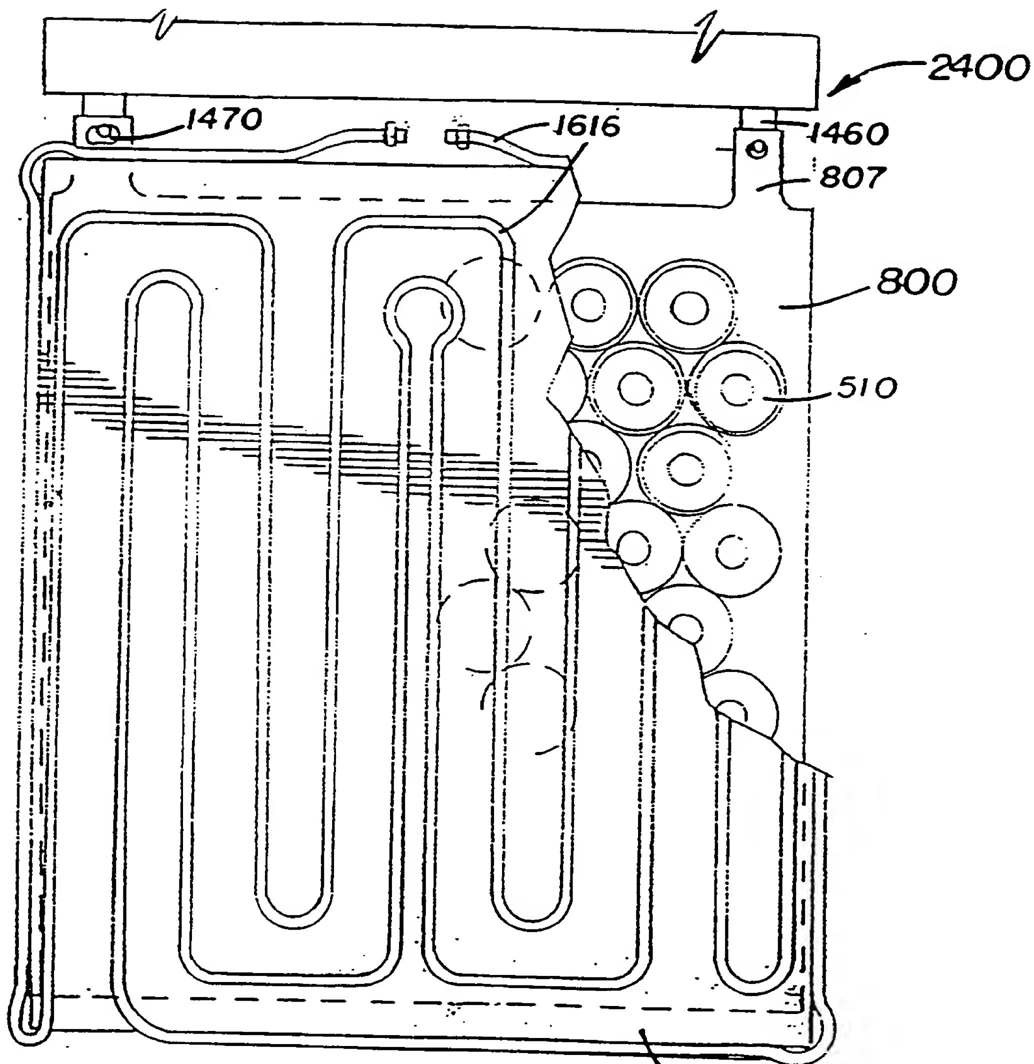


FIGURE 17

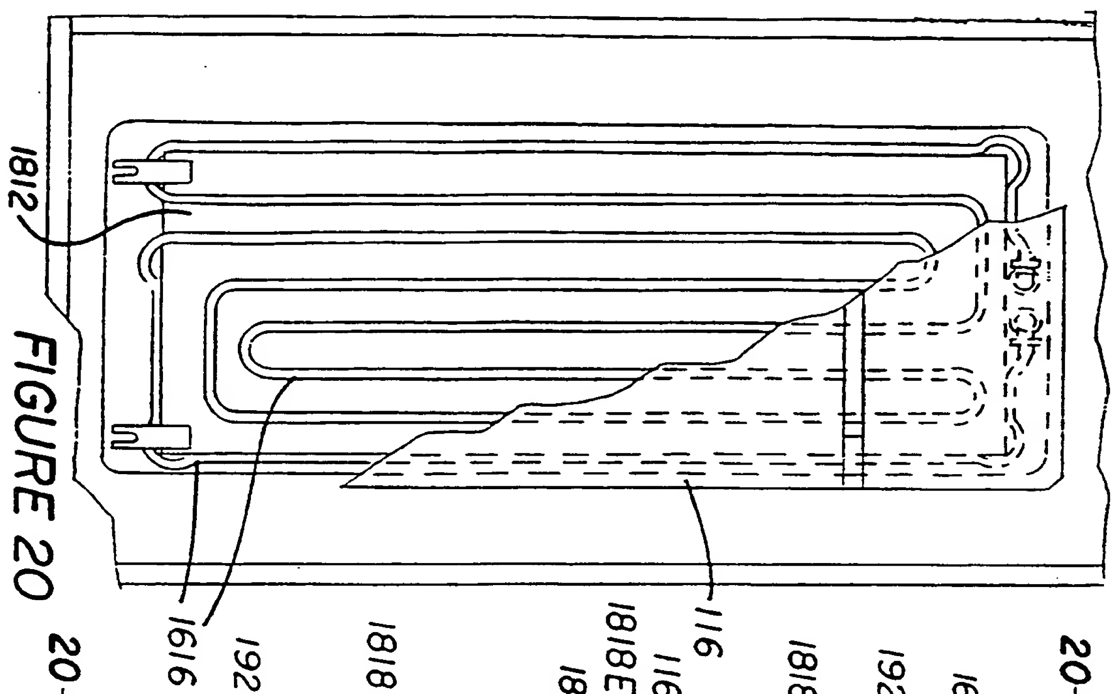


FIGURE 20

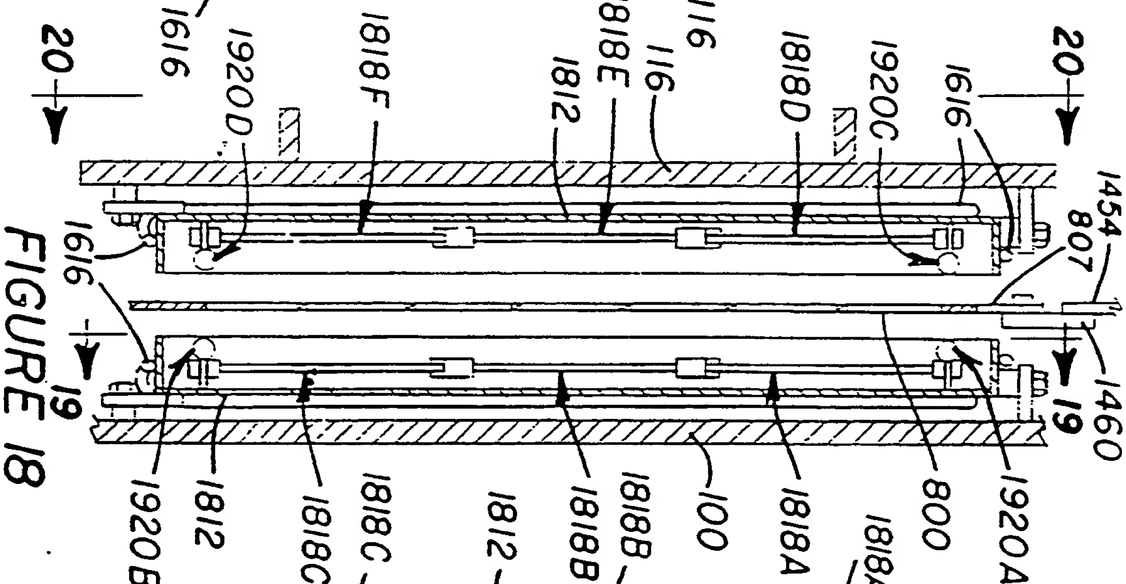


FIGURE 18

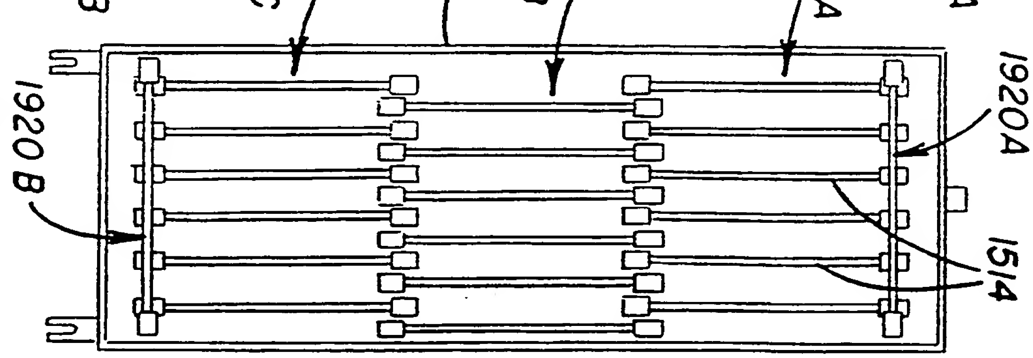


FIGURE 19

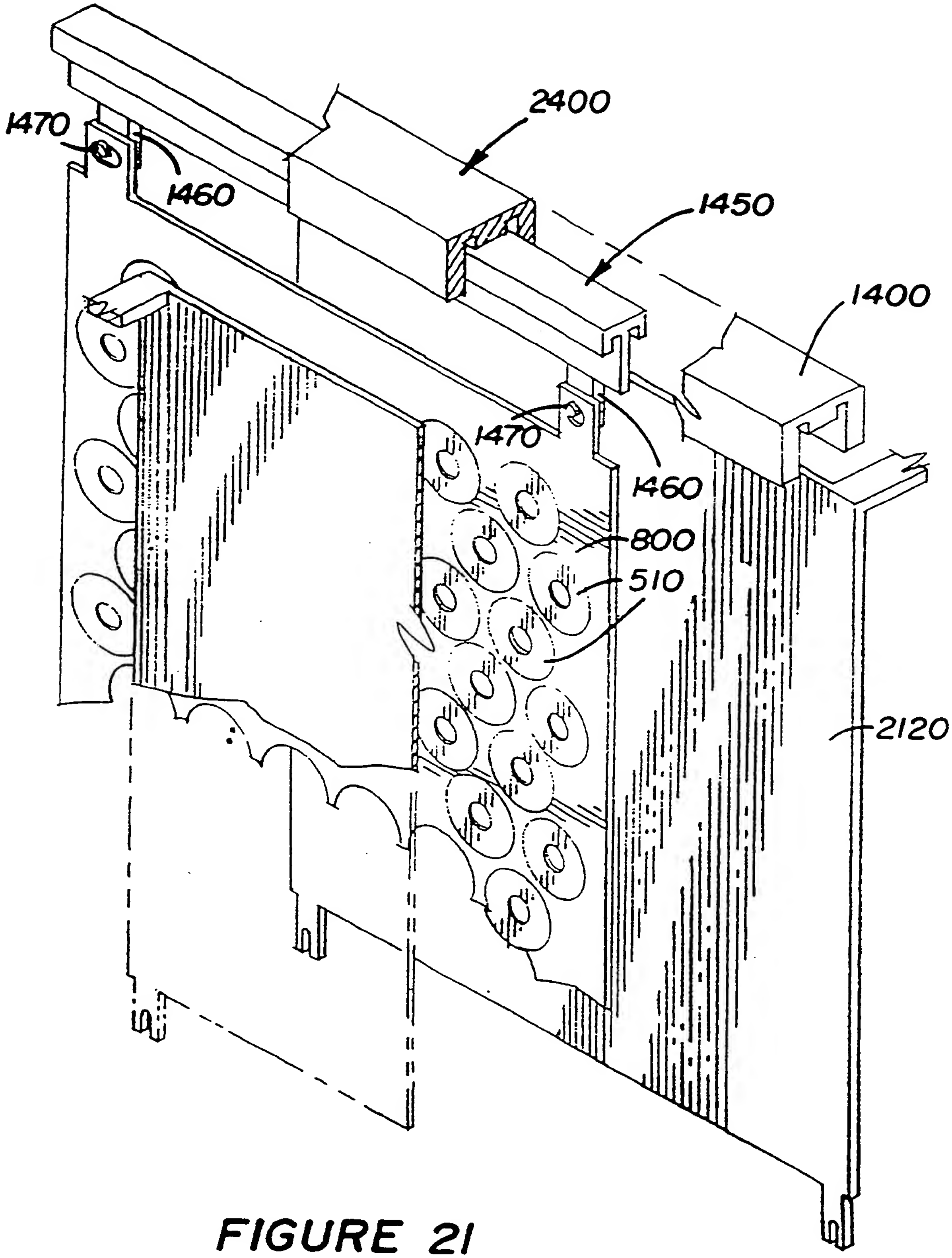
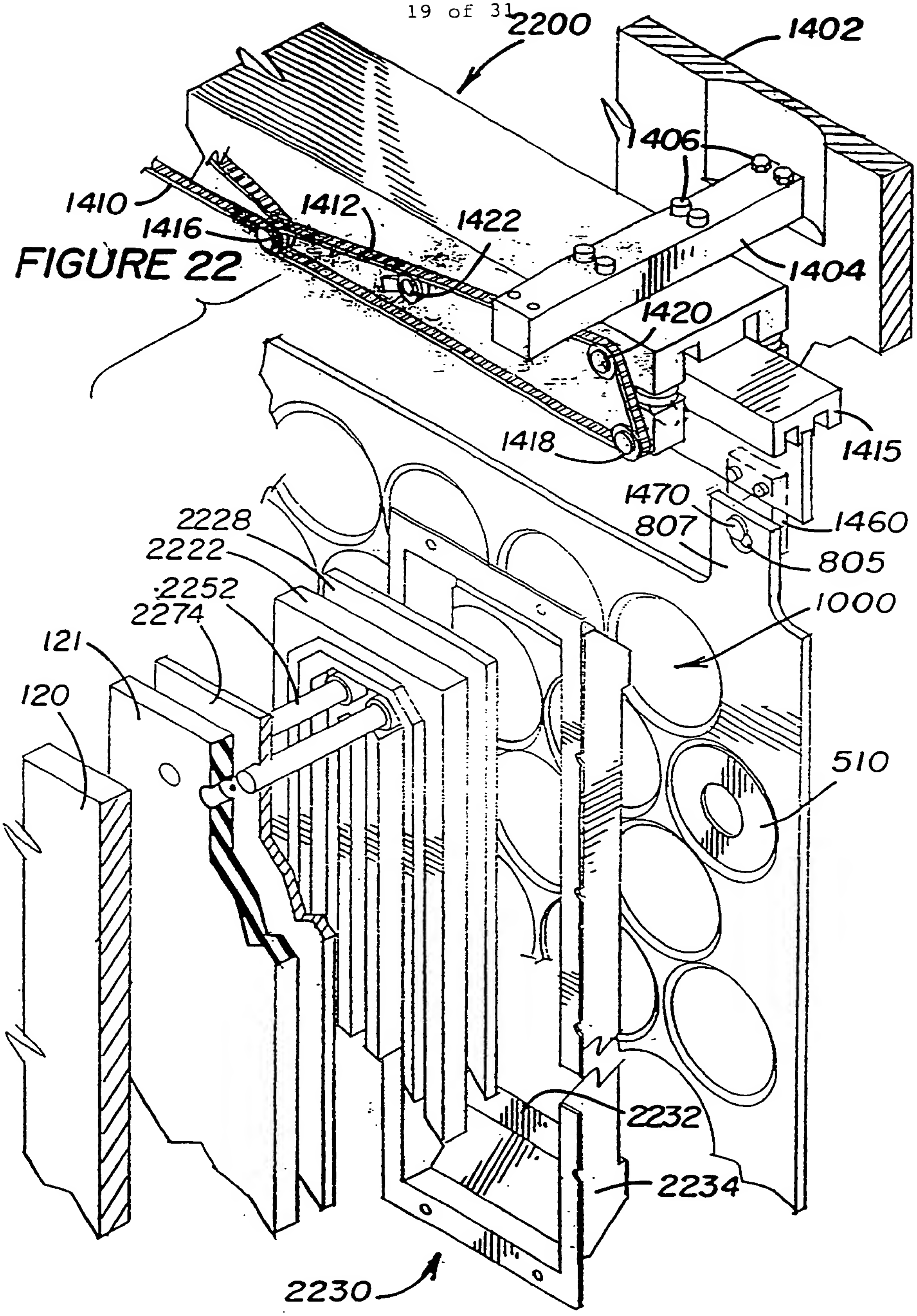


FIGURE 21

FIGURE 22


2200
1402
1406
1410
1412
1416
1422
1404
1420
1418
1415
1470
807
1460
805
2228
2222
2252
2274
1000
121
120
510
2232
2234
2230

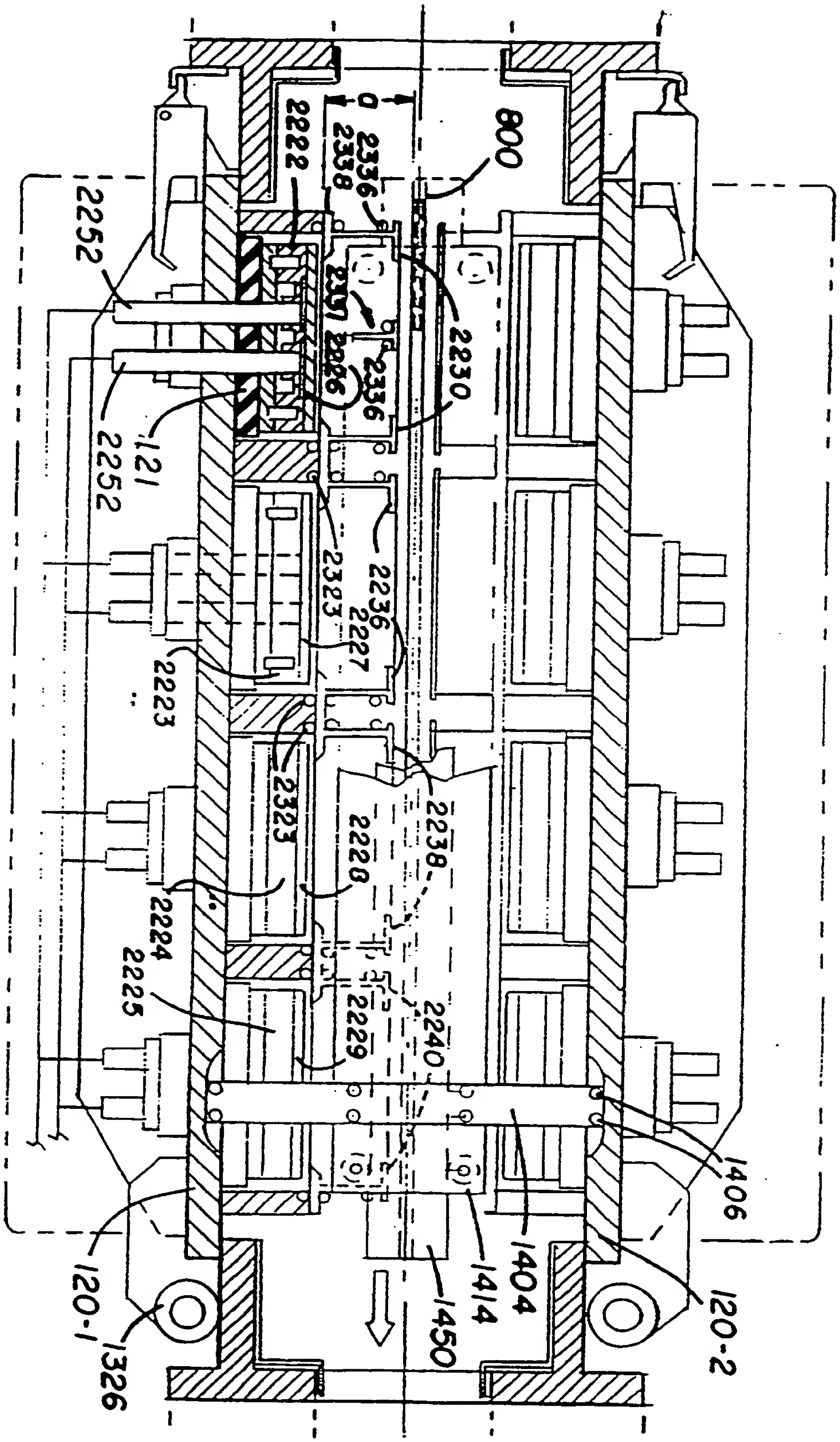

800
D
2336
2338
2222
2230
2237
2226
2336
2230
2252
2252
121
2323
2236
2227
2223
2323
2228
2238
2224
2225
2229
2240
1406
1404
1414
1450
120-1
1326
120-2

FIGURE 23

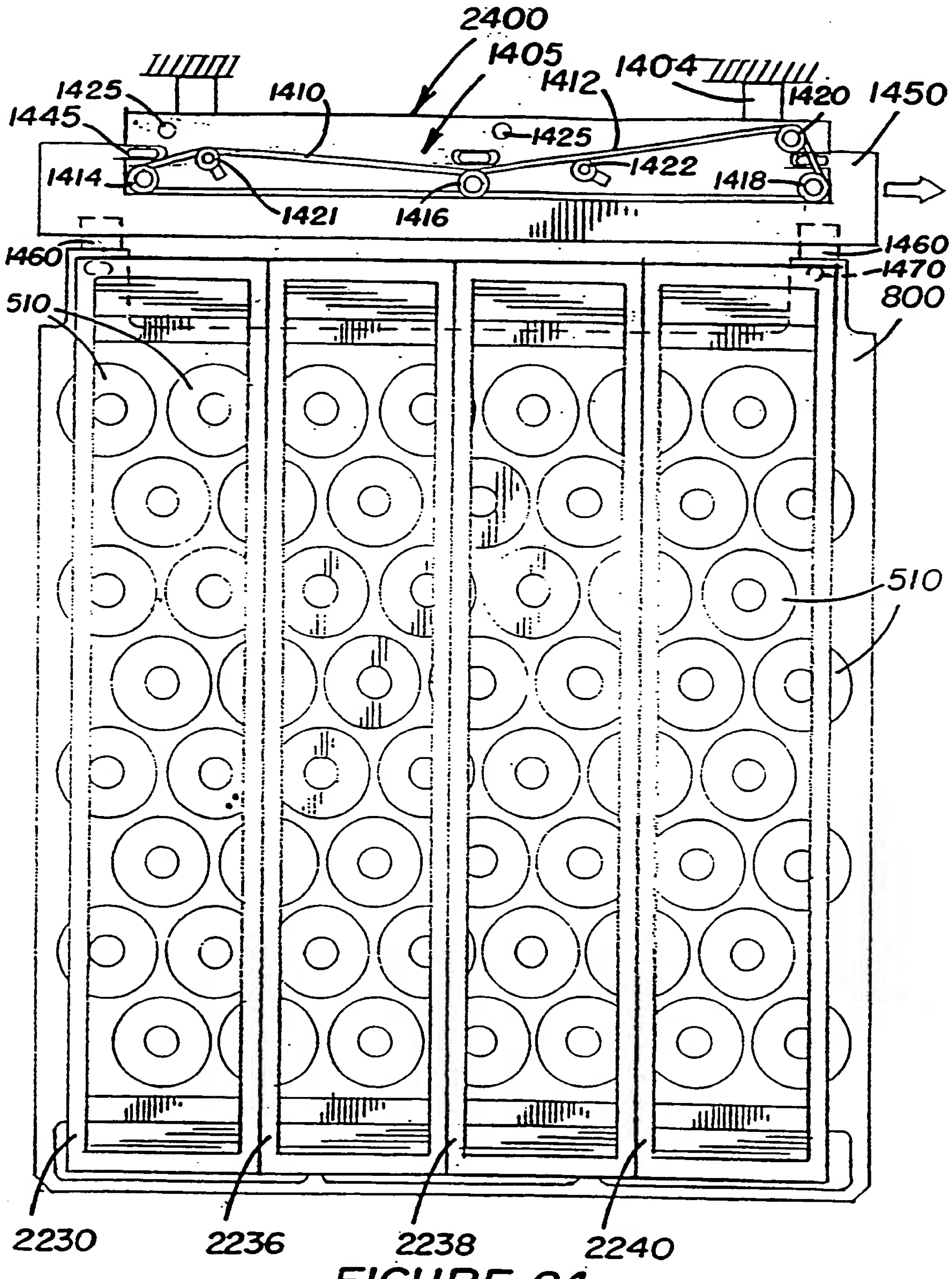

2400
1405
1404
1412
1410
1425
1445
1425
1420
1450
1414
1422
1418
1421
1416
1460
1460
1470
800
510
510
2230
2236
2238
2240

FIGURE 24

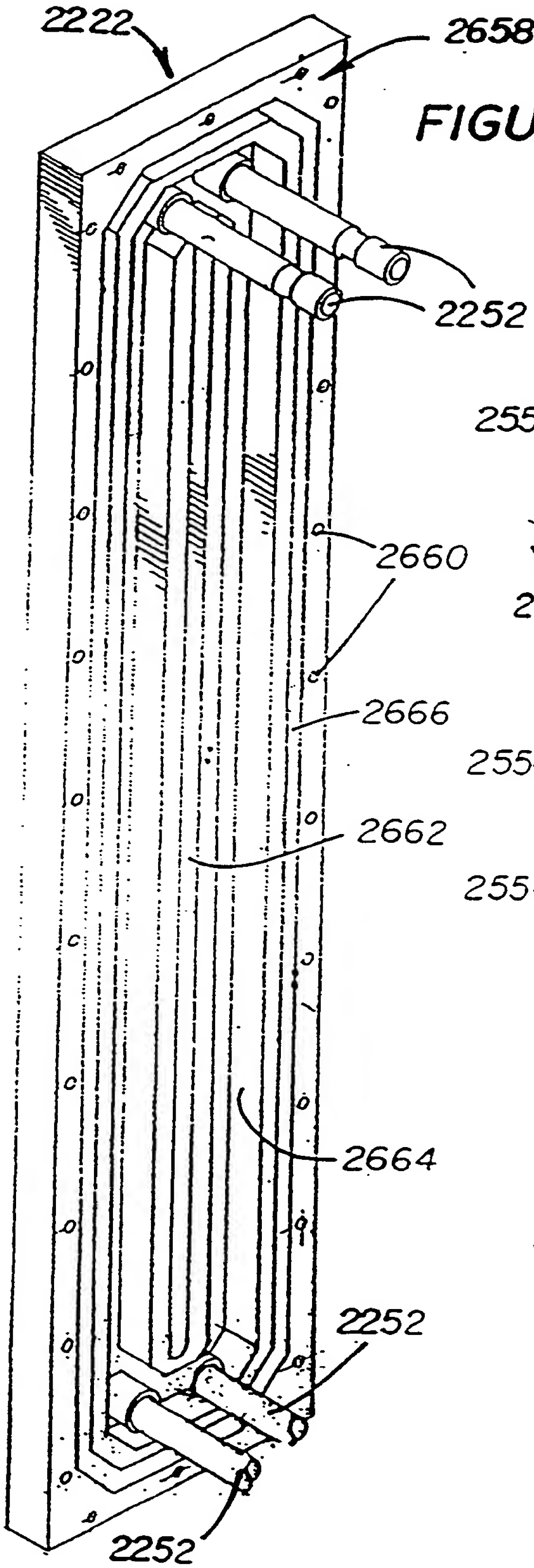


FIGURE 26

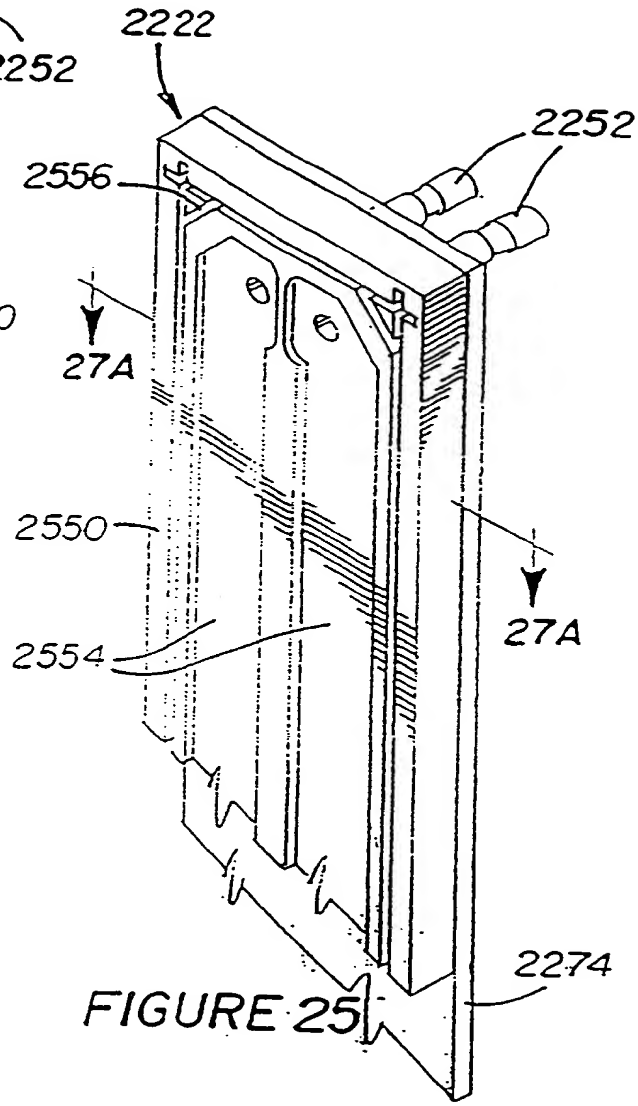


FIGURE 25

FIGURE 27A

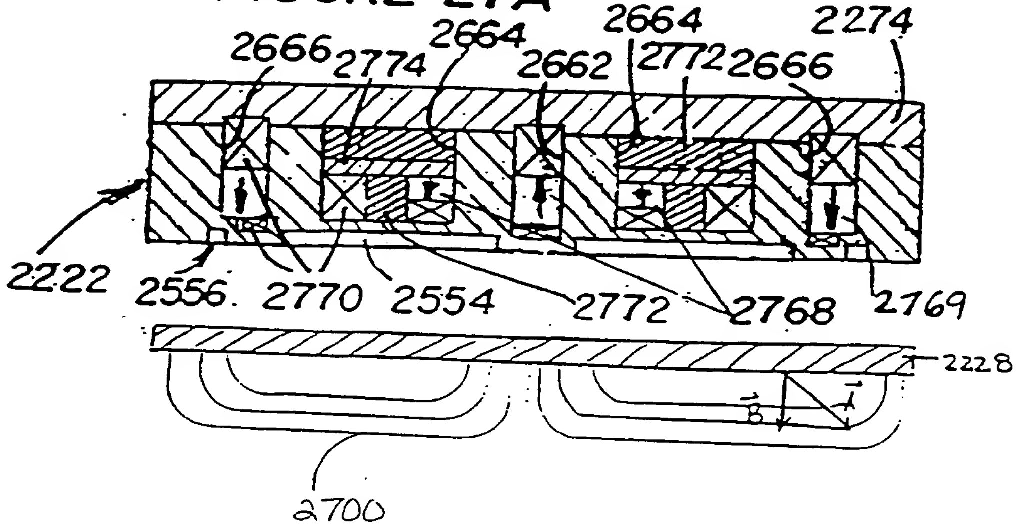
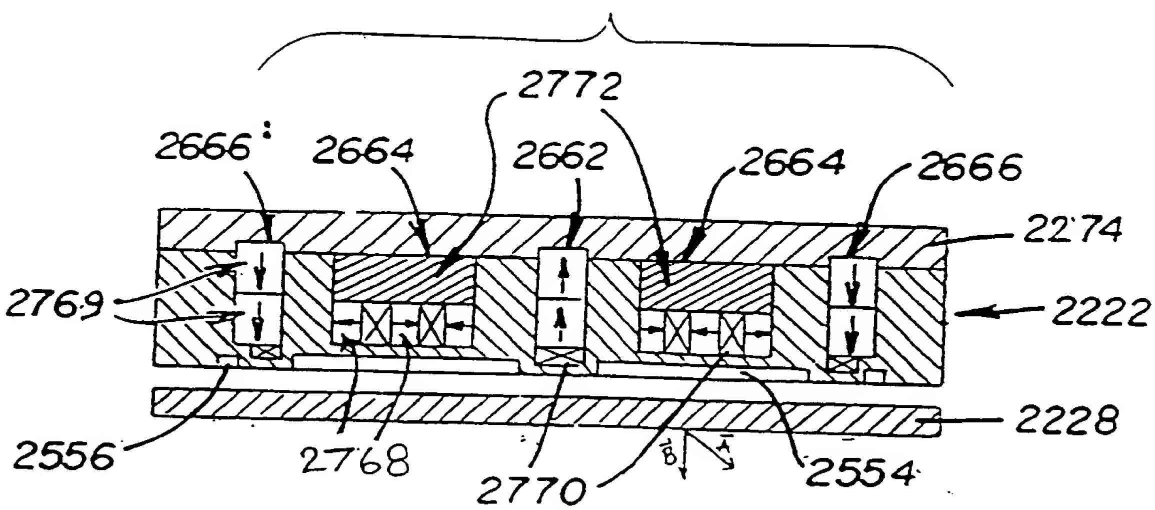


FIGURE 27B



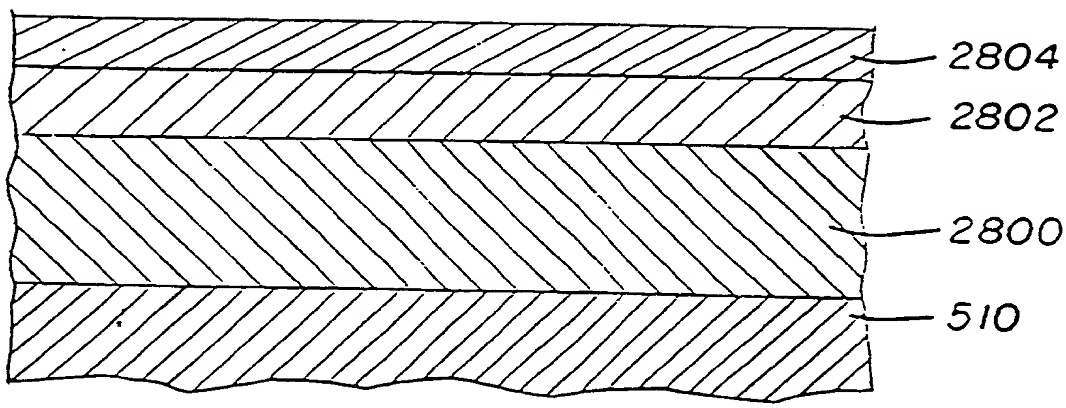


FIGURE 28

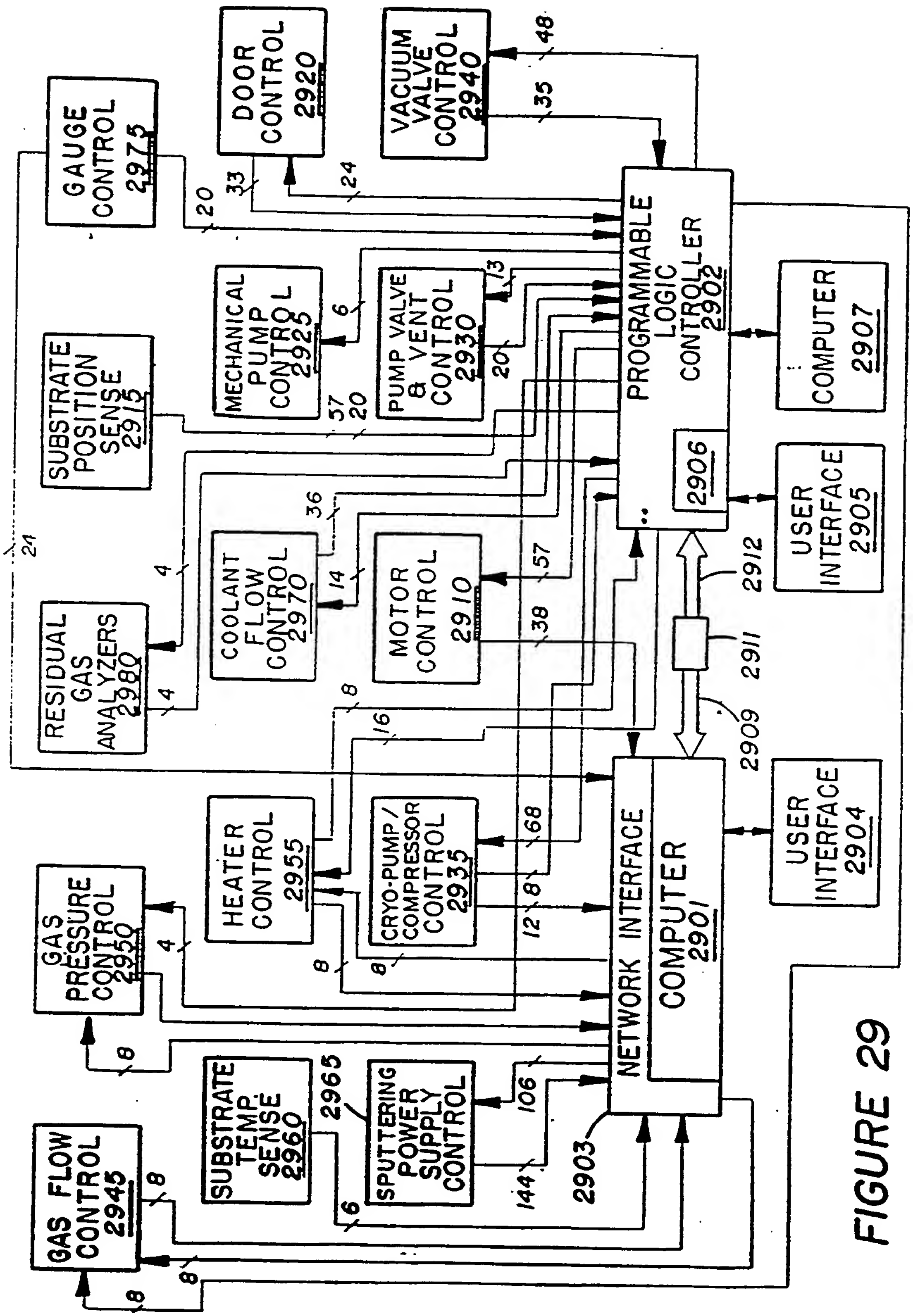

GAUGE CONTROL 2975
DOOR CONTROL 2920
VACUUM VALVE CONTROL 2940
SUBSTRATE POSITION SENSE 2915
MECHANICAL PUMP CONTROL 2925
PUMP VALVE & VENT CONTROL 2930
PROGRAMMABLE LOGIC CONTROLLER 2902
2906
COMPUTER 2907
USER INTERFACE 2905
RESIDUAL GAS ANALYZERS 2980
COOLANT FLOW CONTROL 2970
MOTOR CONTROL 2910
2912
2911
2909
GAS PRESSURE CONTROL 2950
HEATER CONTROL 2955
CRYO-PUMP/ COMPRESSOR CONTROL 2935
NETWORK INTERFACE
COMPUTER 2901
USER INTERFACE 2904
GAS FLOW CONTROL 2945
SUBSTRATE TEMP. SENSE 2960
2965
SPUTTERING POWER SUPPLY CONTROL
2903

FIGURE 29

FIGURE 30

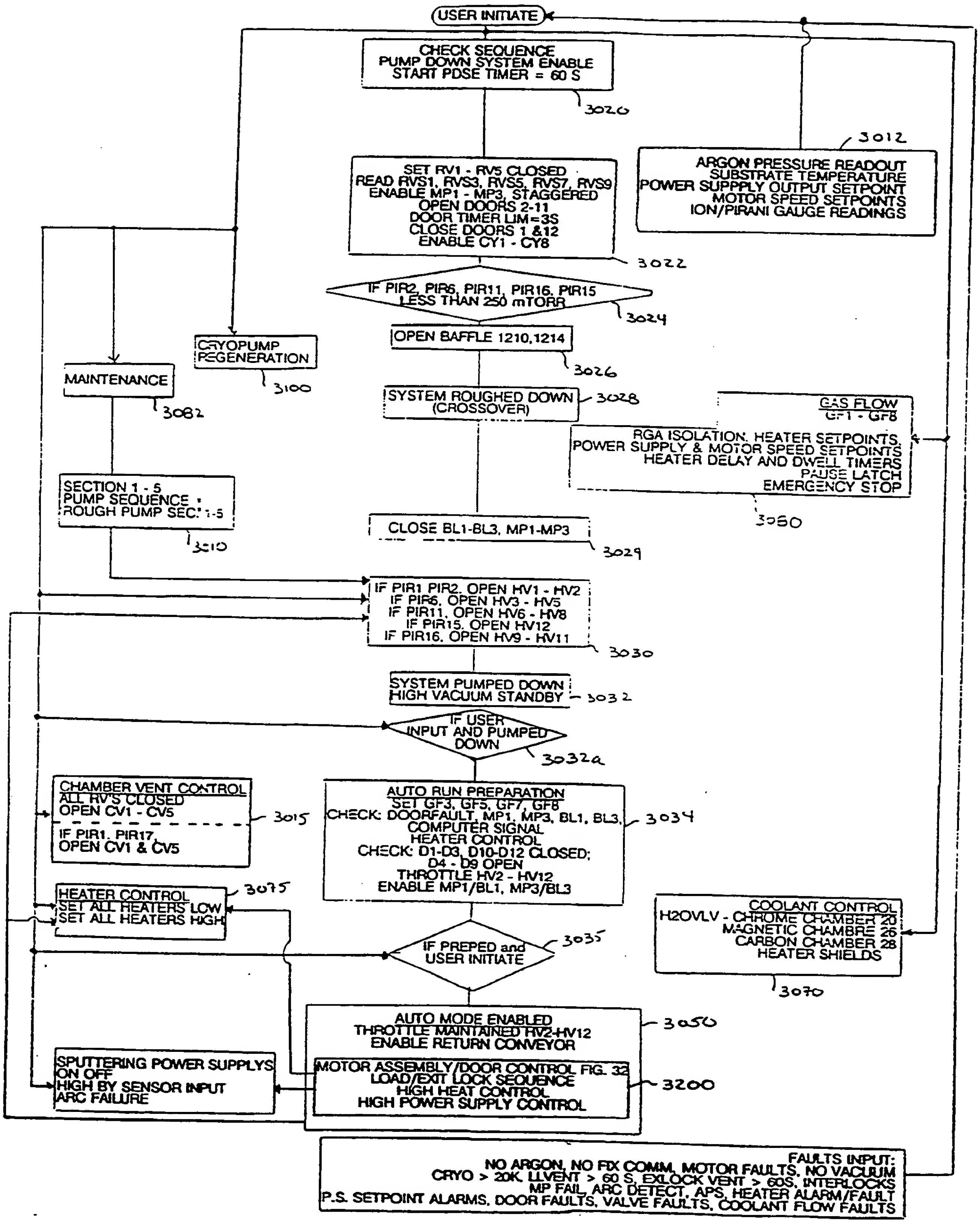
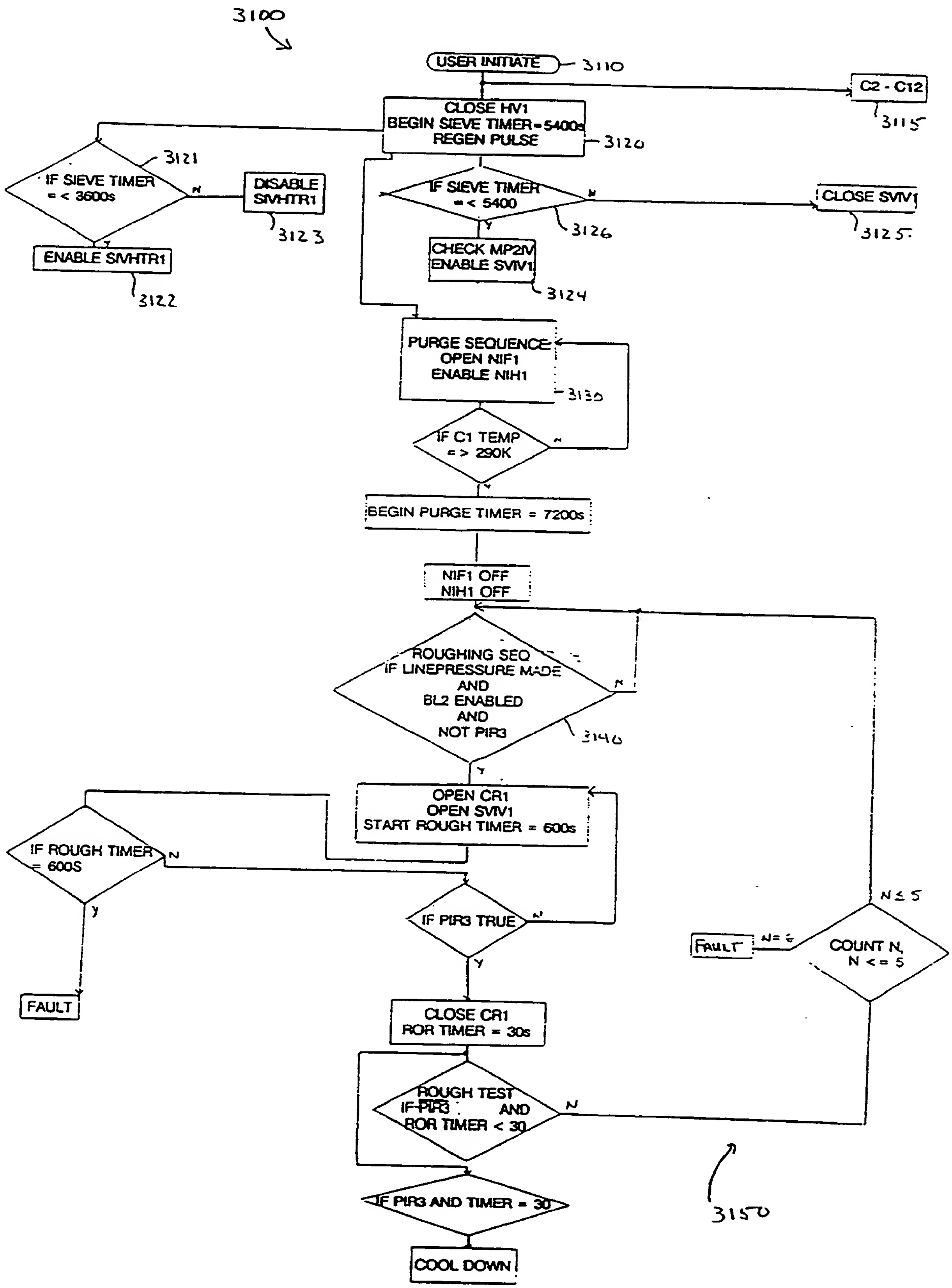

USER INITIATE
CHECK SEQUENCE
PUMP DOWN SYSTEM ENABLE
START PDSE TIMER = 60 S
3020
3012
ARGON PRESSURE READOUT
SUBSTRATE TEMPERATURE
POWER SUPPPLY OUTPUT SETPOINT
MOTOR SPEED SETPOINTS
ION/PIRANI GAUGE READINGS
SET RV1 - RV5 CLOSED
READ RVS1, RVS3, RVS5, RVS7, RVS9
ENABLE MP1 - MP3, STAGGERED
OPEN DOORS 2-11
DOOR TIMER LIM=3S
CLOSE DOORS 1 &12
ENABLE CY1 - CY8
3022
IF PIR2, PIR6, PIR11, PIR16, PIR15
LESS THAN 250 mTORR
3024
OPEN BAFFLE 1210,1214
3026
CRYOPUMP
REGENERATION
3100
MAINTENANCE
3082
SYSTEM ROUGHED DOWN
(CROSSOVER)
3028
GAS FLOW
GF1 - GF8
RGA ISOLATION, HEATER SETPOINTS,
POWER SUPPLY & MOTOR SPEED SETPOINTS
HEATER DELAY AND DWELL TIMERS
PAUSE LATCH
EMERGENCY STOP
3060
SECTION 1 - 5
PUMP SEQUENCE
ROUGH PUMP SEC. 1-5
3010
CLOSE BL1-BL3, MP1-MP3
3029
IF PIR1 PIR2, OPEN HV1 - HV2
IF PIR6, OPEN HV3 - HV5
IF PIR11, OPEN HV6 - HV8
IF PIR15, OPEN HV12
IF PIR16, OPEN HV9 - HV11
3030
SYSTEM PUMPED DOWN
HIGH VACUUM STANDBY
3032
IF USER
INPUT AND PUMPED
DOWN
3032a
CHAMBER VENT CONTROL
ALL RV'S CLOSED
OPEN CV1 - CV5
IF PIR1, PIR17,
OPEN CV1 & CV5
3015
AUTO RUN PREPARATION
SET GF3, GF5, GF7, GF8
CHECK: DOORFAULT, MP1, MP3, BL1, BL3,
COMPUTER SIGNAL
HEATER CONTROL
CHECK: D1-D3, D10-D12 CLOSED;
D4 - D9 OPEN
THROTTLE HV2 - HV12
ENABLE MP1/BL1, MP3/BL3
3034
HEATER CONTROL
SET ALL HEATERS LOW
SET ALL HEATERS HIGH
3075
COOLANT CONTROL
H2OVLV - CHROME CHAMBER 20
MAGNETIC CHAMBRE 26
CARBON CHAMBER 28
HEATER SHIELDS
3070
IF PREPED and
USER INITIATE
3035
AUTO MODE ENABLED
THROTTLE MAINTAINED HV2-HV12
ENABLE RETURN CONVEYOR
3050
SPUTTERING POWER SUPPLYS
ON OFF
HIGH BY SENSOR INPUT
ARC FAILURE
MOTOR ASSEMBLY/DOOR CONTROL FIG. 32
LOAD/EXIT LOCK SEQUENCE
HIGH HEAT CONTROL
HIGH POWER SUPPLY CONTROL
3200
FAULTS INPUT:
NO ARGON, NO FIX COMM, MOTOR FAULTS, NO VACUUM
CRYO > 20K, LLVENT > 60 S, EXLOCK VENT > 60S, INTERLOCKS
MP FAIL, ARC DETECT, APS, HEATER ALARM/FAULT
P.S. SETPOINT ALARMS, DOOR FAULTS, VALVE FAULTS, COOLANT FLOW FAULTS

FIGURE 31


3100
USER INITIATE
3110
C2 - C12
3115
CLOSE HV1
BEGIN SIEVE TIMER=5400s
REGEN PULSE
3120
IF SIEVE TIMER =< 3600s
3121
DISABLE SIVHTR1
3123
ENABLE SIVHTR1
3122
IF SIEVE TIMER =< 5400
3126
CLOSE SIVV1
3125
CHECK MP2V
ENABLE SIVV1
3124
PURGE SEQUENCE
OPEN NIF1
ENABLE NIH1
3130
IF C1 TEMP => 290K
BEGIN PURGE TIMER = 7200s
NIF1 OFF
NIH1 OFF
ROUGHING SEQ
IF LINEPRESSURE MADE
AND
BL2 ENABLED
AND
NOT PIR3
3140
OPEN CR1
OPEN SIVV1
START ROUGH TIMER = 600s
IF ROUGH TIMER = 600S
FAULT
IF PIR3 TRUE
CLOSE CR1
ROR TIMER = 30s
ROUGH TEST
IF PIR3 AND
ROR TIMER < 30
IF PIR3 AND TIMER = 30
COOL DOWN
COUNT N,
N <= 5
N ≤ 5
N = 6
FAULT
3150

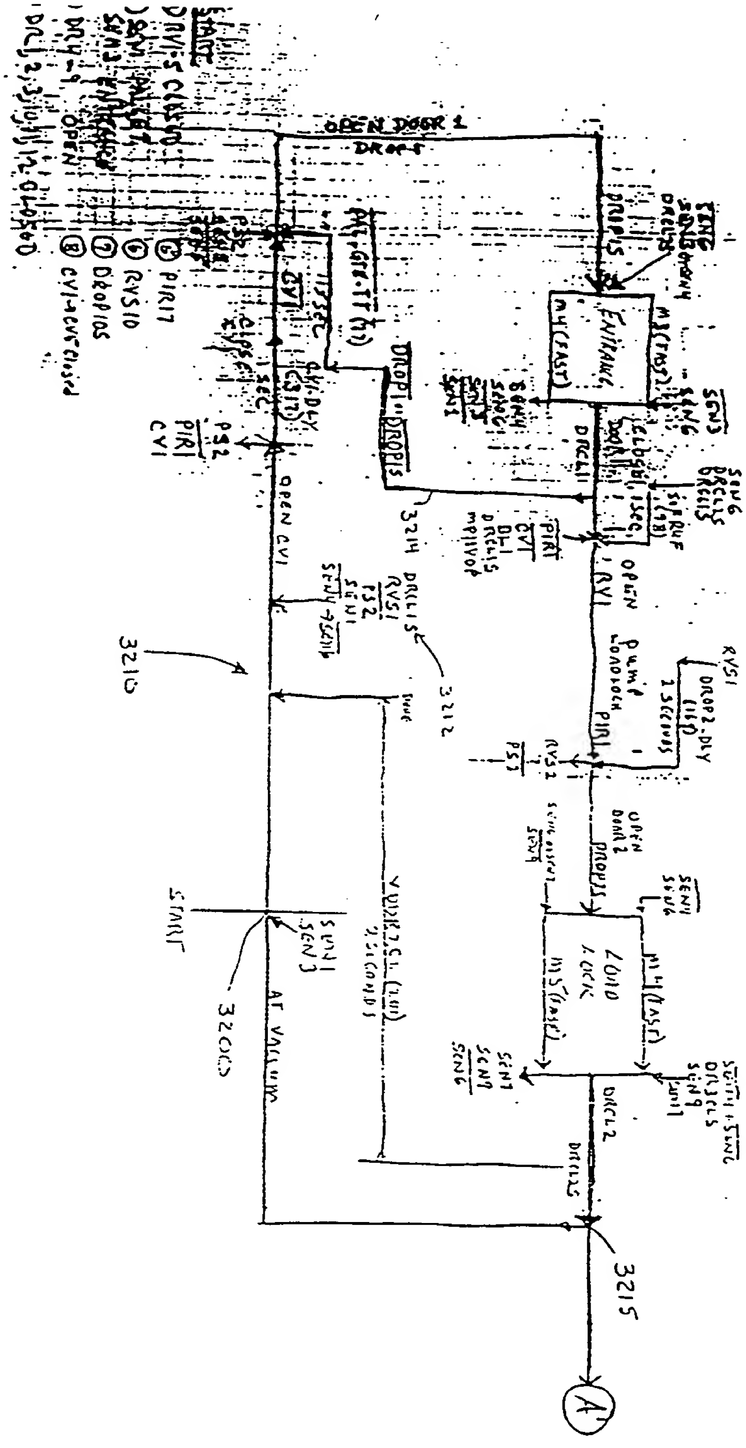


FIGURE 32A

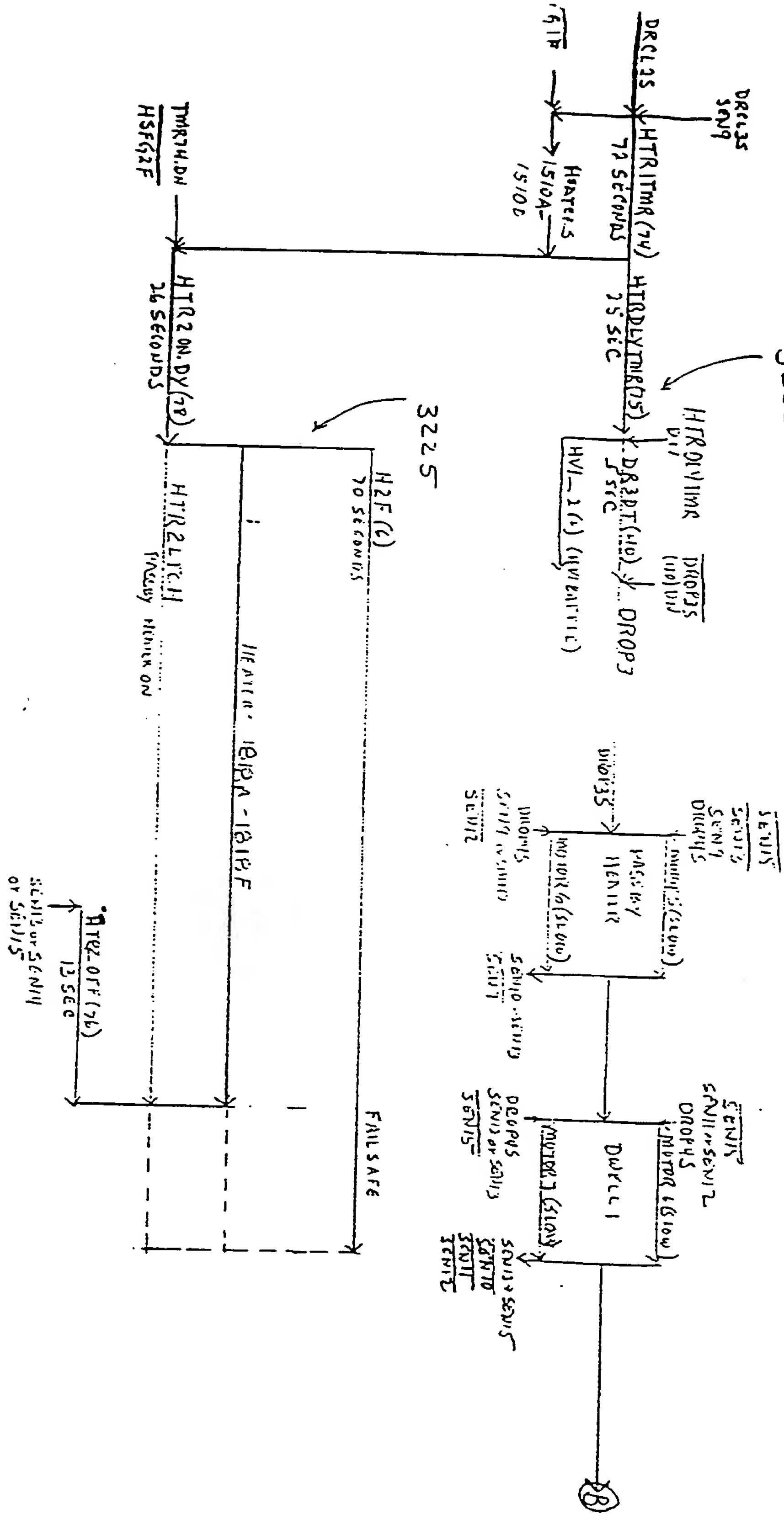

3220
3225
HTR1TMR(74)
72 SECONDS
HTRDLYTMR(75)
25 SEC
HTR2ON.DY(78)
26 SECONDS
H2F(6)
70 SECONDS
FAILSAFE
DROP3
PASSIVY HEATER
DWELL 1
HTR2_OFF(76)
13 SEC

FIGURE 32B

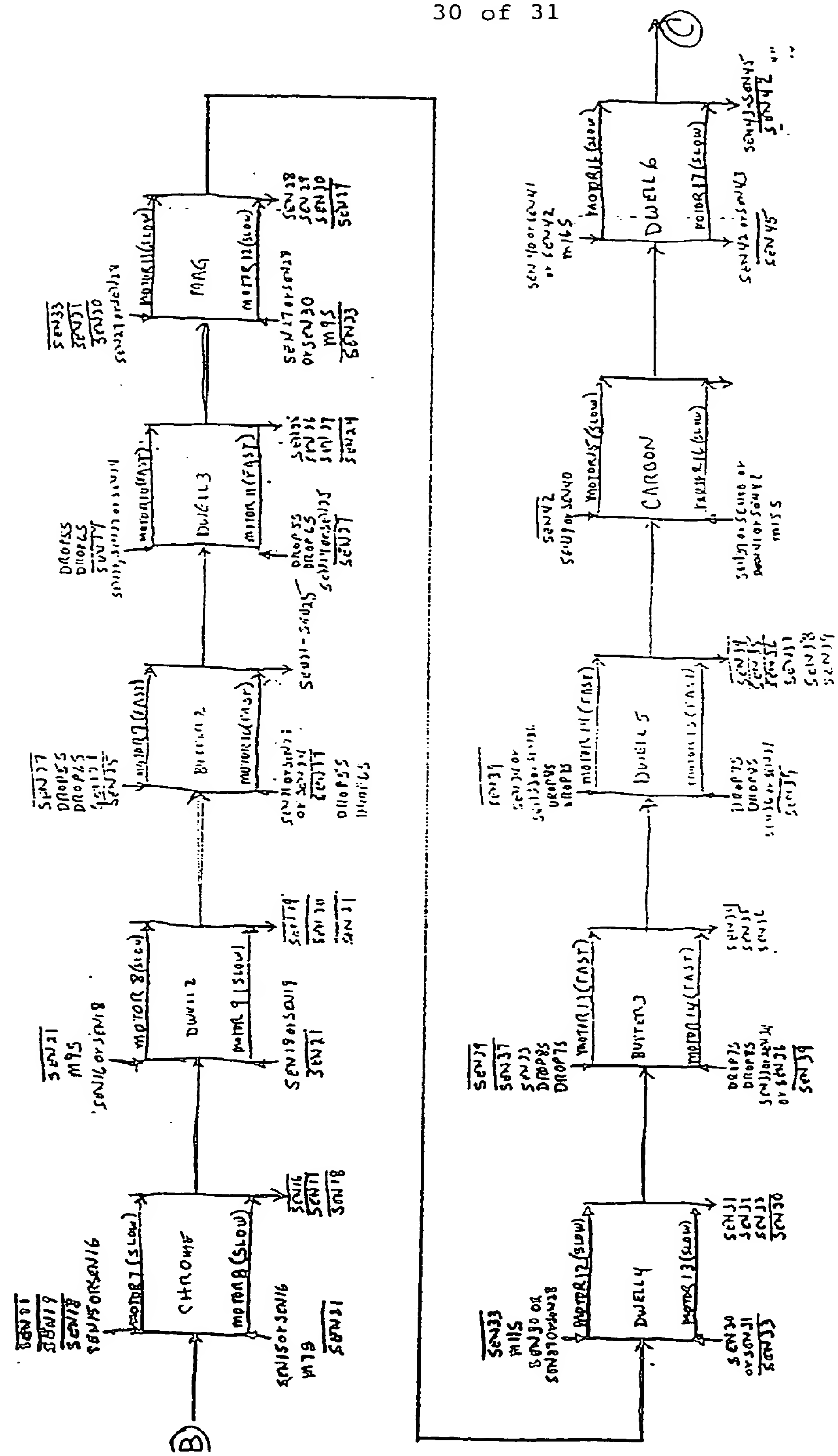

CHROME
DWELL 2
BUFFER 2
DWELL 3
MAG
DWELL 4
BUFFER 3
DWELL 5
CARBON
DWELL 6

FIGURE 32C

INTERNATIONAL SEARCH REPORT

International Application No. PCT/US92/00722

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[3]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC (5): C23C 14/34
US CL : 204/192.125,298.23

II. FIELDS SEARCHED

Minimum Documentation Searched[4]

Classification System	Classification Symbols
U.S.	204/192.12,192.16,192.2,298.23,298.25,298.26,298.27,298.09

Documentation Searched other than Minimum Documentation to the extent that such Documents are included in the Fields Searched[5]

III. DOCUMENTS CONSIDERED TO BE RELEVANT[14]

Category*	Citation of Document,[16] with indication, where appropriate, of the relevant passages[17]	Relevant to Claim No. [18]
X	US, A, 4,663,009 (BLOOMQUIST ET AL.) 05 May 1987, see the entire document.	1-4
X	US, A, 4,749,465 (FLINT ET AL.) 07 June 1988, see the entire document.	1-4
Y	US, A, 4,894,133 (HEDGCOTH) 16 January 1990, see columns 7 and 8.	5

* Special categories of cited documents:[15]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search[2]	Date of Mailing of this International Search Report[2]
29 JUNE 1992	31 JUL 1992
International Searching Authority[1]	**Signature of Authorized Officer[20]**
ISA/US	NAM X. NGUYEN

Form PCT/ISA/210 (second sheet)(May 1986) ß

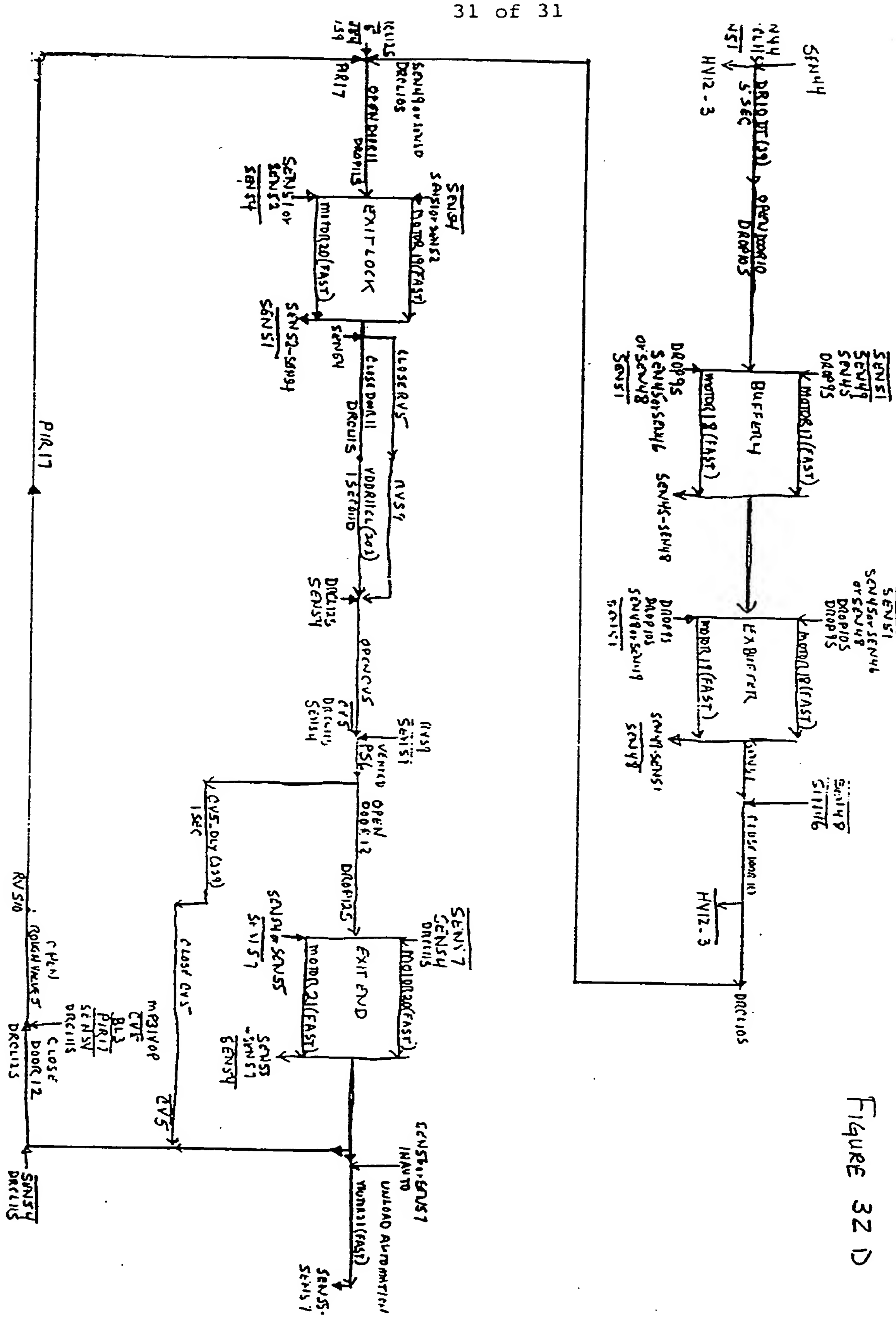


FIGURE 32 D